

AUSTRALIAN CUMACEA No. 8
THE FAMILY BODOTRIIDAE

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[Read 10 August 1944]

Fig. 1-38

INTRODUCTION

Herein are recorded further new species, secured mainly by the Fisheries Division of the Commonwealth Council for Scientific and Industrial Research in the shallow waters off eastern Australia.

A satisfying natural classification of the Cumacea does not seem possible, at least at present. The genera and the grouping of the genera are based largely upon the loss or reduction of parts; this seems unavoidable in an Order embracing forms which, on the whole, are unadventurous in their departures from a basic uniformity. While the pleopods and the exopods of the peraeopods in their number serve in part as generic indicators, the ultimate result of placing undue emphasis upon these factors is exemplified in the classification proposed by Stebbing in 1913, who, using them freely as criteria, separates a relatively large number of families from the older ones, many containing only a few species. Acceptance of this system does not seem to be justified, particularly as it is reasonable to suspect that further loss convergences will be found to occur (see also Hansen, 1920, 3).

Family BODOTRIIDAE

In a recent discussion of the species of *Cyclaspis* (Hale, 1944), that genus was placed in the subfamily Bodotriinae, having the characters of the Bodotriidae as formerly limited.

It has become increasingly evident that the family Vaunthompsoniidae, unless possibly one restricts it to the type genus, is by no means easily separable from the Bodotriidae and that probably the two families should be united (Hansen, 1895, 57; Calman, 1910, 616; Zimmer, 1913, 444, etc.). It is now submitted that there is support for the division of the Bodotriids into two subfamilies, the Bodotriinae and Vaunthompsoniinae, limiting the former to those genera which completely lack exopods on all peraeopods excepting the first. This again associates *Heterocuma* and *Cumopsis* with the *Vaunthompsonia* group of genera.

Other characters for possible subdivision of the family present themselves, but the writer still feels that this would be premature.

As *Bodotria* is the oldest genus of the whole assembly and it is often held that a family should take its name from the earliest described genus included in it, the long quoted Bodotriidae is here retained although Sars' Vaunthompsoniidae has precedence of proposal.

Subfamily BODOTRIINAE

Genera: *Bodotria* Goodsir, 1828; *Iphinoe* Bate, 1856; *Cyclaspis* Sars, 1865; *Stephanomma* Sars, 1871; *Eocuma* Marcusen, 1894; *Cyclaspoides* Bonnier, 1896; *Zygosphon* Calman, 1907.

No trace of exopods on any but the first pair of peraeopods. There is more often than not a reduction in number of the free thoracic somites and the endopod of the uropod is often undivided.

A two-jointed endopod is found in the uropod of *Iphinoe* (where as far as known it is constant), in *Bodotria* (where it is inconstant and in the single species of *Zygosiphon*).

The second antenna of the female is in general more rudimentary than in the Vaunthompsoniinae. The lamellae of the branchial apparatus are apparently never digitiform and on the whole do not show the reduction in number which occurs in *Vaunthompsonia* and *Bathycuma* spp. (see Zimmer 1908, 165, etc.), and in *Gephyrocuma*, although in *Zygosiphon* they are few, particularly in the female (*vide* Calman).

Iphinoe resembles *Vaunthompsonia* more than do the other genera, all of which have characters never occurring in the Vaunthompsoniinae. Some slight additional support for its association with the Bodotriinae is afforded by *I. pellucida* sp. nov. which has abdominal articular pegs as in *Cyclaspis*.

Three of the genera, *Cyclaspoides*, *Stephanomma* and *Zygosiphon*, are monotypic. The last-named is sharply differentiated by the wide separation of its branchial siphons, *Cyclaspoides* by having only two of the pedigerous somites free. *Stephanomma* appears to be a *Cyclaspis* in which the fusion of the pseudorostral suture, sometimes found in the highly calcified members of the last-named genus, is very complete (Calman 1907, 14). The other four genera occur in both Hemispheres and, as might be expected, are represented in Australian seas.

Genus BODOTRIA Goodsir

***Bodotria maculosa* sp. nov.**

Adult Male (South Australian form). Integument firm, moderately calcified but not brittle; finely reticulate.

Carapace with dorsal edge scarcely arched, rugose; one-fourth of total length of animal, depressed, about one-fifth as wide again as depth, which is a little more than half its length; median carina low; sides with a prominent longitudinal ridge, below which is a less marked carina which curves up posteriorly to meet the main ridge; above the latter the carapace exhibits a coarse squamose-reticulate patterning formed by large, shallow pits; the lower lateral carina is emphasised by a line of shallow pits immediately above it. Antennal notch deep and narrow, tooth subacute. Pseudorostral lobes wide and truncate anteriorly and reaching apex of ocular lobe, which is as wide as long with nine prominent yellowish lenses.

First pedigerous somite concealed; second about as long as fourth or fifth but longer than third; on each somite there is a strong median carina, elevated posteriorly on the third to fifth somites, and a prominent lateral carina formed by the upper edge of a pronounced subquadrangular area on the lower half.

Pleon stout, the first five somites each with dorsal carina, and with faint lateral ridge, which becomes successively less distinct.

Margins of thoracic appendages and uropods more or less serrate. First antenna with first joint of peduncle stout, longer than rest of appendage; second joint longer and stouter than third; main flagellum stout, two-jointed, shorter than third peduncular joint.

Basis of third maxilliped half as long again as rest of limb and with apical lobe rather wide; ischium unusually long, distinctly longer than merus or carpus which are dilated apically; dactylus downbent in subchelate fashion.

First pereopod stout, the carpus barely reaching to level of antennal tooth; basis about half as long again as rest of limb, not produced apically; carpus a little longer than merus, twice as long as the unusually short propodus and more

than three times as long as the dactylus, which is two-thirds as long as propodus; dactylus with a stout terminal spine as long as itself and two or three short setae.

Basis of second peracopod barely longer than remaining joints together; merus longer than carpus, equal in length to dactylus and twice as long as propodus; dactylus with no lateral spines, longer than the longest of its three terminal spines, which is twice as long as the others.

Basis as long as remaining joints together in third legs, shorter in fourth and fifth pairs; propodal seta not quite reaching apex of dactylus; a single carpal seta (at base of which is an insignificant bristle) not reaching beyond middle of length of dactylus.

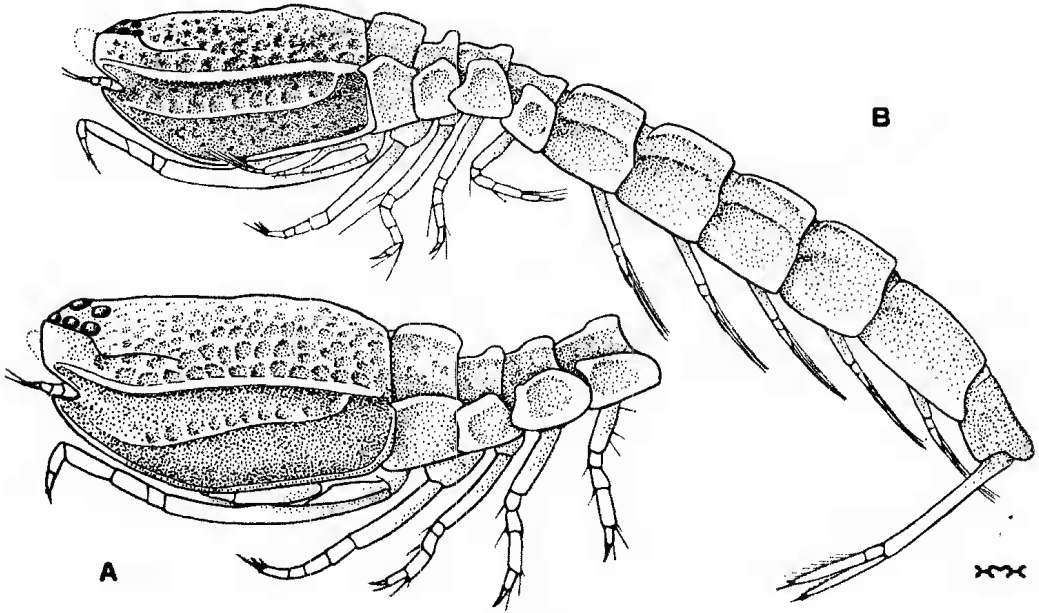


Fig. 1

Bodotria maculosa. A, Side view of cephalothorax of type male of South Australian form. B, Side view of type of New South Wales form. (Both $\times 40$).

Peduncle of uropod one and three-fourths times as long as telsonic somite and with a fringe of plumose hairs on whole length of inner margin; endopod single-jointed, equal in length to telsonic somite, slightly longer than exopod, and with eleven spines on inner margin and a long and a short spine on truncate apex; exopod with plumose hairs on inner margin and with a long and a short terminal spine on truncate apex.

Colour yellow in alcohol, marked with numerous black spots (ground colour orange during life).

Length, 4.2 mm.

Loc.—South Australia: Spencer Gulf, Memory Grove, 3 fath., 8 to 8.30 p.m. (K. Sheard, Feb. 1941), and Dangerous Reef, 4 fath., "Whiting bottom" (*type loc.*, K. Sheard, Mar. 1941, 8 to 8.30 p.m.); and Stickney Island, 3 fath. (K. Sheard, Feb. 1944); St. Vincent Gulf, Corny Point, 2 fath., over sand (K. Sheard, Feb. 1941, 8 to 8.30 p.m.), and Rapid Bay (E. Hanka, H. Cooper and A. Rau, Jan. 1944); Kangaroo Island, Antechamber Bay, 4 fath., 8 to 8.30 p.m. (K. Sheard, April 1941). Type in South Australian Museum, Reg. No. C.2365.

The specimens, all males, were taken by submarine lights. The colour spots vary in number and disposition, but the bright ground colour is of assistance in sorting material.

The spines on the endopod of the uropod vary from nine to twelve.

Adult Male (New South Wales form). Differs from the above in the following characters. The size is smaller and the colour in alcohol is white with dark spotting; the squamose pitting of the carapace is more pronounced. The thoracic appendages are slightly more slender with longer spines and setae. In the first peraeopods the dactylus is not much shorter than the propodus and the main terminal seta is longer than the dactylus. The longest dactylar spine of the

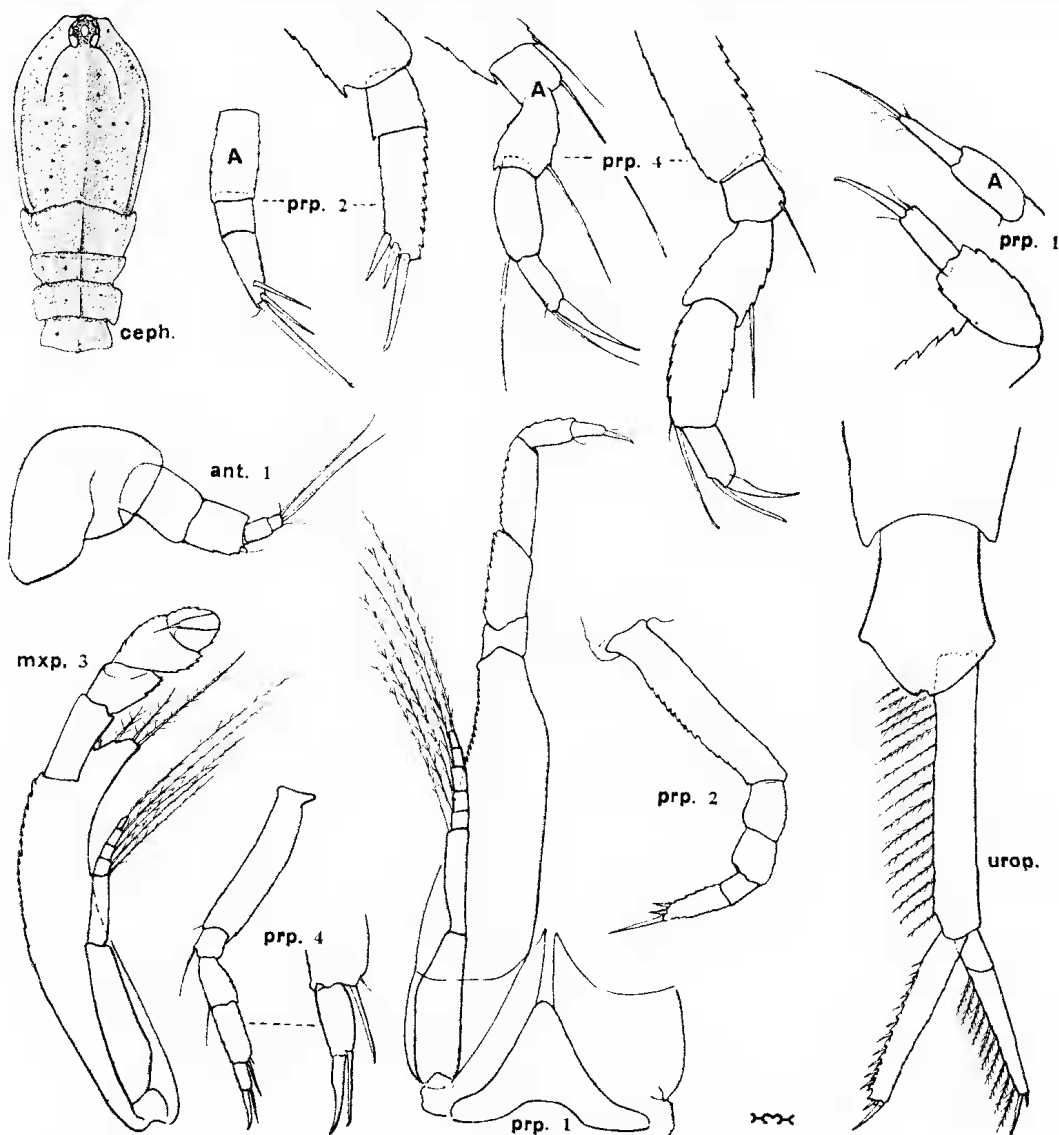


Fig. 2

Bodotria maculosa, paratype male of South Australian form; ceph., cephalothorax from above (x 20); ant. 1, first antenna (x 175); mxp. 3, third maxilliped (x 82); prp. and urop., peraeopods, and uropod with telsonic somite (x 82); terminal joints of peraeopods (x 175). A, Terminal joints of peraeopods of New South Wales form (x 175).

second peraeopods is longer than the propodus and dactylus together, and the main carpal and the propodal seta of the last three pair of legs reach quite to the tip of the dactylus (cf. 2 and 2 A, all to same magnification).

Length, 3.5 mm.

Smaller examples, 1.5 mm. to 1.9 mm., have the upper lateral carina of the carapace strong but the lower less apparent, it being defined by the edges of a row of pits which are less marked than in the adult. The rami of the uropods are three-fourths as long as the peduncle.

Loc.—New South Wales: off Port Hacking, 50 metres on sand (*type loc.*), and off Wata Mooli, 35 metres on sand (K. Sheard, June 1942, and "Cronulla" Trawl Station 2, July 1943). Type in South Australian Museum, Reg. No. C.2448.

B. maculosa resembles *arenosa* Goodsir, but is separated at a glance by the posteriorly elevated dorsal carinae of the last three pedigerous somites, the wider form, the relatively shorter peduncle of the uropods, etc.

B. pumilio Zimmer (1921, 119, fig. 4-7) is also similar in appearance but the adult is smaller (2 to 2.25 mm.) and, according to Zimmer's figure of the male, the carinae of the last three pedigerous somites are not elevated posteriorly.

Genus EOCUMA Marcusen

EOCUMA AGRION Zimmer

Eocuma agrion Zimmer 1914, 176, fig. 1-2.

Zimmer's specimens were taken at Fremantle (Perth), South-western Australia. The species also occurs at Cronulla (Sydney) on the eastern coast (Hale and Sheard, submarine light, 8 feet, September 1942 and January 1944).

In life the colour is yellowish, the pleon being semi-transparent, and the deep pitting of the carapace is conspicuous. The uropods are held wide apart; the rami of each are also spread to form a wide V, the exopod directed upwards and the endopod downwards. The pleon is very flexible.

These specimens agree with the original description excepting that the size is larger and the tiny second peraeopods have not the five joints (apart from coxa) shown in Zimmer's small fig. 2 d. In both sexes they consist of basis plus two other joints, each of which is about the same length as the basis; there are two unequal terminal setae, one being longer than any of the aforementioned three joints.

Zimmer describes the female of this curious species in detail and briefly mentions a damaged male.

Adult Male. Integument thin, calcified and brittle. Pitting varying on pleon but always distinct on carapace.

Carapace plus the fused pedigerous somite fully one-fourth of total length; depressed, and with its depth less than half length; cornua larger than in female; antennal notch widely open and angle rounded. Ocular lobe much wider than long, slightly constricted at base; corneal lenses not darkly pigmented; there is a large tunid central lens and two on each side. Pseudorostrum shorter than in female; there is a tubercle alongside a pit at the termination of each pseudorostral suture.

Free pedigerous somites depressed, wider than in female (see figures).

The pleon is much stouter than in the female; the telsonic somite has two median dorsal conical projections (the hinder one the larger) and is subtruncate posteriorly.

The first antenna has the third peduncular joint longer than second and half as long as first, which is expanded in distal half; the short flagellum is four-jointed, the accessory lash single-jointed.

There are about 17 closely packed, long lamellae in the branchial apparatus. Third maxilliped much as in female.

First peraeopod with basis nearly one-third as long again as rest of limb.

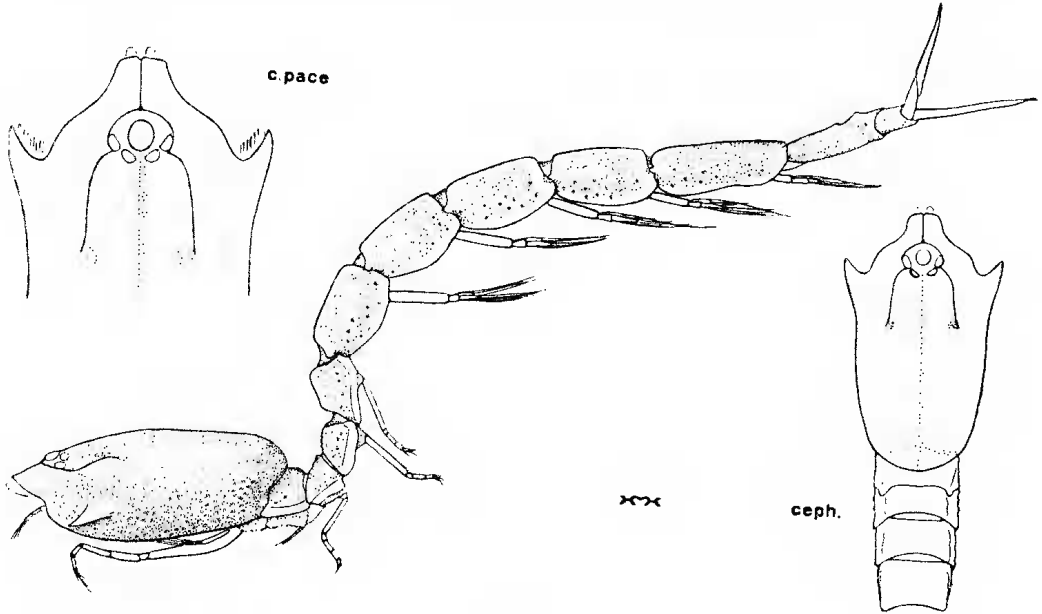


Fig. 3

Eocuma agrion, male, from the side and (ceph.) cephalothorax from above (x 18); c. pace, anterior portion of carapace from above (x 30).

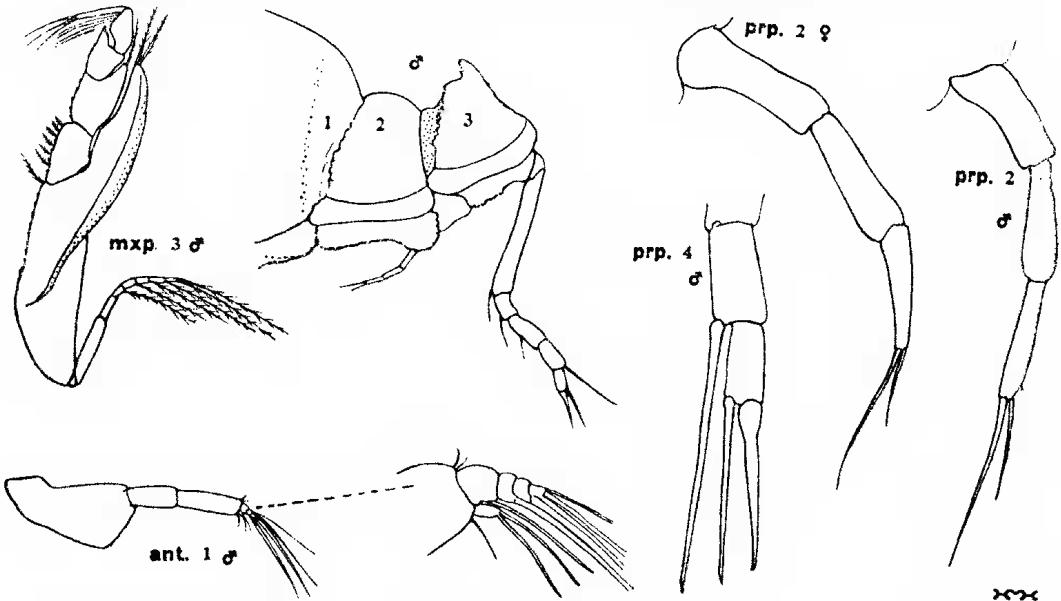


Fig. 4

Eocuma agrion; ant. 1, first antenna (x 160; flagella x 320); mxp. 3, third maxilliped (x 70); 1, 2 and 3, first to third pedigerous somites (x 54); prp. 2, second peraeopod (x 320); prp. 4, terminal joints of fourth peraeopod (x 160).

Third to fifth peracopod with one stout carpal seta which, with that of propodus, reaches to the level of the tip of the slender dactylus.

Peduncle of uropod as deep as telsonic somite and less than one-third as long as rami.

Length, 6 mm. to 8 mm.

Genus *IPHINOE* Bate

Iphinoe pellucida sp. nov.

Ovigerous female. Integument rather thin, although lightly calcified, with faint pitting.

Carapace with dorsal edge scarcely arched, with a slight angle between ocular lobe and the distinct pseudorostrum; one-fourth of total length of animal, and with depth about two-thirds its length and about equal to greatest breadth; subtriangular as seen from above, the sides evenly rounded; a very fine though

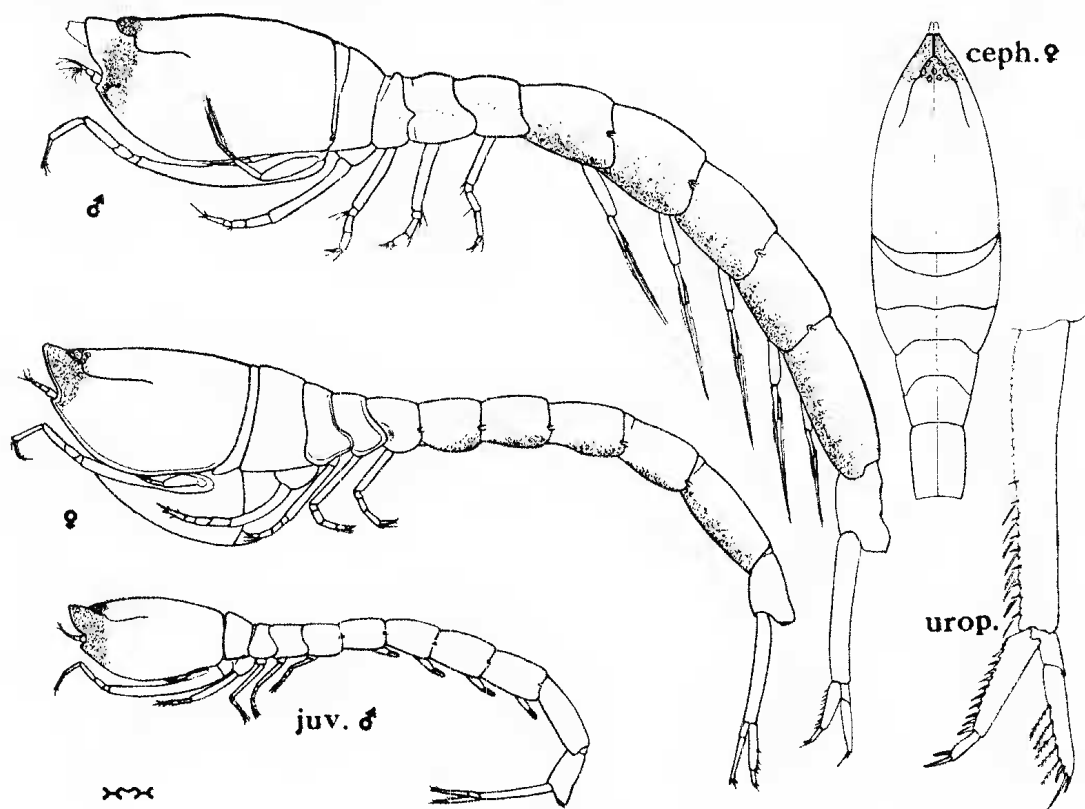


Fig. 5

Iphinoe pellucida, allotype adult male, and paratypes ovigerous female and young male, from the side (x 27); ceph., cephalothorax of ovigerous female from above (x 27); urop., uropod of adult male (x 67).

distinct dorsal carina; an indistinct depression on each side of anterior portion of median carina. Antennal notch wide and shallow; antennal tooth obtuse. Pseudorostral lobes meeting in front of ocular lobe for a distance equal to length of latter (about one-tenth of carapace). Ocular lobe as wide as long, with seven colourless lenses, the median one not sharply defined.

Five pedigerous somites exposed, the first short, but visible for whole of depth; second somite longer than third, fourth or fifth; all somites with a fine median carina.

Pleon with fine median carina on each somite including telson; first to fifth with distinct lateral articular pegs.

First antennae with basal joint almost as long as remaining joints together; second and third subequal in length, each as long as the two-jointed flagellum.

Basis of third maxilliped nearly twice as long as rest of limb, with outer lobe long and triangular; merus, carpus and propodus dilated.

First peraeopod with carpus attaining level of antennal tooth; basis a little longer than remaining joints together; carpus and propodus subequal in length, each nearly twice as long as dactylus, which is longer than the longest of its half-dozen terminal setae.

Basis of second peraeopods longer than rest of limb; merus as long as carpus and propodus together and barely longer than dactylus; the last-named has a stout terminal spine almost as long as itself, two short flanking spines, and a short spine on each side at middle of length. Fossorial legs sparsely armed, with propodal and carpal setae not reaching to apex of dactylus; one stout seta plus a very short one on carpus.

Peduncle of uropod slender, with closed serrations on inner edge; more than half as long again, as the exopod; endopod a little longer than exopod, distinctly two-jointed, the first segment almost three times as long as the second, serrate and armed with four stout spines on inner edge; second segment serrate on inner edge and with a long and a short terminal spine; exopod with three spines at apex, the middle much the longest, and half the length of the second segment.

Colour: milky, translucent with a sooty band across anterior portion of carapace.

Length, 4.66 mm.

Adult Male. Differs from the female in the narrower carapace and pedigerous somites and the deeper pleon. The first pedigerous somite is less exposed; inner margin of peduncle of uropods with serrations rather more pronounced and with two series of spines in posterior half, the upper short, at right angles to margin, the others oblique and serrate; first joint of endopod with about ten spines on inner edge and second with minute inner spines and two unequal terminal spines; exopod with three distal spines as in female (the inner is really subdistal) and a few plumose setae on inner margin.

Length, 4.6 mm.

Young Male. The juvenile male illustrated has tiny serrations on the dorsal crest of the carapace behind the ocular lobe and the first pedigerous somite is almost completely concealed. Differs otherwise in usual immature characters—uropods relatively a little wider, etc.

Loc.—Tasmania: off Babel Island, 0-50 metres ("Warreen" Station 29, 1939). New South Wales: stomach of Morwong or Jackass Fish (*Dactylopagrus macropterus*) (A. C. Simpson, July 1939); off Wata Mooli, 70 metres ("Cronulla" Trawl Station 4, July 1943); off Eden, 30 metres, trawled on coarse sand (K. Sheard, October 1943); four miles east of Port Hacking, 80 metres on mud (K. Sheard, trawled, May 1944); Ulladulla, 75 metres (*type loc.*, K. Sheard, trawled, June 1944). Types in South Australian Museum, Reg. No. C.2539 and 2540.

A large number of specimens is available. The pigmentation of the anterior part of the carapace, although more extensive in some examples than in others, is a very characteristic feature; there is usually also pigmentation at the lower edge of the first five pleon somites. The colouration, shape, and extended pleon

of preserved material render it easy of recognition amongst a mass of small Crustacea.

Some ovigerous females are over 5 mm. in length, others smaller than the type. The paratype female in fig. 5 is 4 mm. in length, and young from the marsupium are 0·8 mm. in length.

Lateral articular pegs are present on the pleon as in most if not all of the species of *Cyclaspis*—indeed, but for two characters, the suppression of the ischium of the second legs and the two-jointed endopod of the uropod, *I. pellucida* would be referable to that genus.

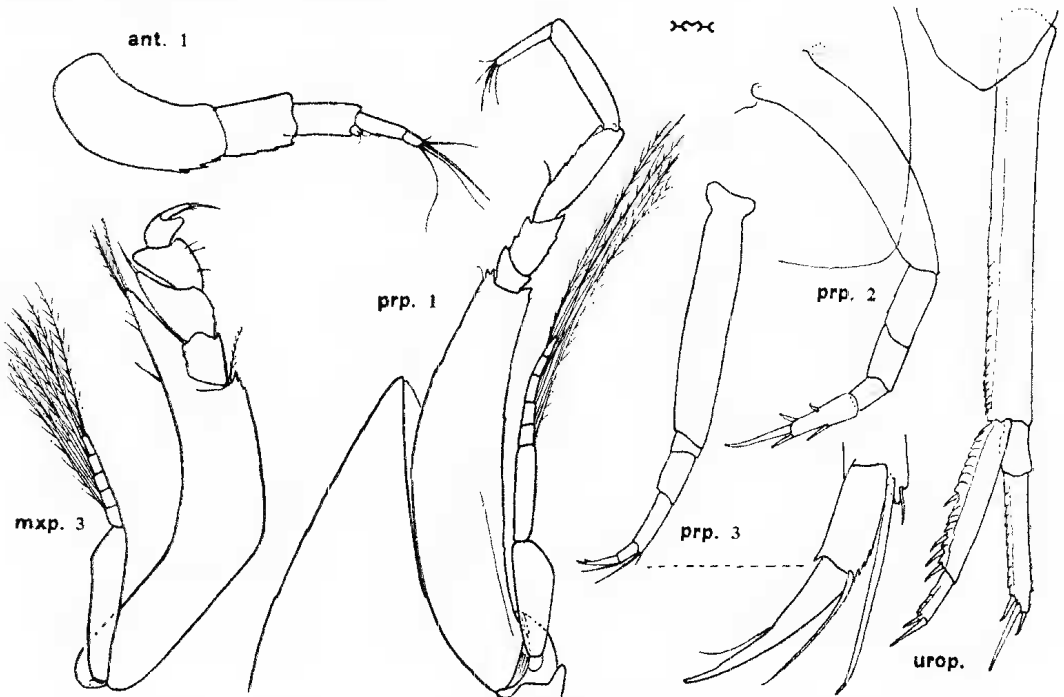


Fig. 6

Iphinoe pellucida, paratype ovigerous female; ant. 1, first antenna; mxp. 3, prp. and urop., third maxilliped, pereopods and uropod ($\times 82$; terminal joints, $\times 350$).

Although the general facies is very different, the only concise characters separating *Iphinoe* from *Bodotria* seem to be the complete absence of lateral carinae on the compressed carapace and the rather prominent pseudorostrum.

Like *crassipes* Hansen, *pellucida* has the first joint of the endopod of the uropod much longer than the second; it is readily separated by the different proportions of the first pair of pereopods and other features.

Subfamily VAUNTHOMPSONIINAE

Exopods on at least the first three pairs of pereopods.

Always five pedigerous somites are exposed and the endopod of the uropod is two-jointed. The second antenna of the female is often 3-jointed, and in most genera the terminal, more or less conical, joint is distinctly separated off.

KEY TO GENERA OF SUBFAMILY VAUNTHOMPSONIINAE

- | | | |
|---|---|---|
| 1 | Basis of third maxilliped greatly expanded interiorly. First pereopods with joints curiously expanded | 2 |
| | Basis of third maxilliped not expanded interiorly. First pereopods not so modified. | 4 |

- 2 Picon unusually short, never more than two-thirds as long as cephalothorax. First antenna strongly geniculate, with joints of peduncle subglobose. *Gephyrocuma* Hale
- Pleon not unusually short, at least as long as cephalothorax. First antenna not strongly geniculate, and joints not at all globose 3
- 3 Telsonic somite subtruncate, scarcely produced posteriorly. Basis of third maxilliped with large inner distal lobe and basis of first peraeopod with no distal lobe *Zenocuma* gen. nov.
- Telsonic somite well produced posteriorly. Basis of third maxilliped with no inner distal lobe and basis of first peraeopod with distal lobe. *Pomacuma* gen. nov.
- 4 Second peraeopod with a distal brush of setae on propodus and dactylus, but no spines. Fourth peraeopod of female with small exopod *Leptocuma* Sars.
- Second peraeopod without brushes of setae on terminal joints, but with spines on at least dactylus. Fourth peraeopod of female without exopod 5
- 5 Dorsal plate of telsonic somite subtruncate posteriorly and not at all produced between bases of uropods 6
- Dorsal plate of telsonic somite rounded or somewhat angular posteriorly and produced between bases of uropods 7
- 6 Dorsal plate of telsonic somite truncate posteriorly. Endopod of pleopods with narrow external process. External distal portion of basis of third maxilliped not produced and bearing about five stout plumose setae *Cumopsis* Sars.
- Dorsal plate of telsonic somite excavated posteriorly. Endopod of pleopods without external process. External distal portion of basis of third maxilliped produced as a prominent lobe capped with two stout plumose setae. *Heterocuma* Miers
- 7 Third maxilliped with external distal portion of basis not at all, or not strongly, produced and with ischium short (much wider than long); merus much longer than ischium but shorter than carpus *Vaunthompsonia* Bate
- Third maxilliped with external distal portion of basis prominently produced and with ischium at least as long as wide, subequal in length to merus and carpus 8
- 8 Eye present. Pseudorostral lobes not reaching beyond ocular lobe 9
- Eye absent. Pseudorostral lobes reaching forward and beyond level of front of ocular lobe 10
- 9 Fourth peraeopod of male with exopod *Glyphocuma* gen. nov.
- Fourth peraeopod of male without exopod *Sympadomma* Stebbing
- 10 Pseudorostral lobes meeting in front of ocular lobe. Telsonic portion of last pleon somite much shorter than rest of somite *Bathycuma* Hansen
- Pseudorostral lobes not meeting in front of ocular lobe. Telsonic portion of last pleon somite as long as rest of somite *Gaussicuma* Zimmer

The Australian species which have come to hand are of considerable interest. Although investigation of our waters is by no means comprehensive as yet, it is evident that this subfamily is well represented but does not equal the Bodotriinae in number of species and individuals because of the ever present *Cyclaspis*, which is the dominant genus of the family, at least on sandy bottoms. It seems also that *Vaunthompsonia* itself is rare and that the important elements group themselves around three main types, represented by *Sympadomma* Stebbing, *Leptocuma* Sars and *Gephyrocuma* Hale. The last of these comprise what might be termed the "operculate" genera and are here dealt with first.

THE OPERCULATE GENERA

In these the first pair of peraeopods can be folded to form the major part of an operculum which bridges the space between the infero-lateral folds of the carapace, and closes the cavity of the latter from the exterior; these limbs and the third maxillipeds also are curiously expanded and otherwise modified.

Zimmer (1921, 4) described a single young male, which he did not dissect, of the first of such species from North-Western Australia, referring it temporarily

to *Vaunthompsonia*; what appears to be his species—*australiae*—is now available from eastern Australia.

The present writer (Hale 1936, 412) subsequently proposed a genus, *Gephyrocuma*, for the reception of a second operculate species, which possesses first legs very much as in Zimmer's form (excepting that the basis lacks a distal lobe) but which has the third maxilliped very different, the basis of that appendage being not only more widened interiorly, but at the anterior end sweeping forward and inward to form a broad, truncate lobe. Another species of this genus is described herein.

There is also before me a large species related to the small *Gephyrocuma* and with similar third maxilliped but with other differences warranting generic separation; for this a new genus, *Zenocuma*, is erected. A further species is accommodated, with Zimmer's *australiae*, in a third genus, *Pomacuma* nov.

The basis of the third maxilliped and first peracopod is widened and more or less twisted, or flanged, in all three genera. In the first peracopod the ischium is in the form of a rounded lobe with an exterior excavation. The articulations between ischium, merus, carpus and propodus allow for a complete folding of the appendage (Zimmer refers to it as subchelate). The inner portions of the carpus and, to a lesser extent, the propodus, are dilated, and in the carpus lamellate. The proximal portion of the dactylus is swollen on the upper or outer face. There is a dense distal brush of long plumose setae on the inner side of the propodus and on that of the dactylus, while there is a row of plumose setae on the carpus.

The development of plumes of setae on the terminal joints of the first legs is by no means unique in the Cumacea, although the operculate genera are unusually well endowed. The "grasping motions" of *Gephyrocuma pala* (Hale 1943, 341) suggest that the algal debris found in the stomach and massed around the mouth may be collected in the same way as is the food of Porrellanid crabs and non-parasitic Cirripedia. It should be mentioned that amongst smaller material found beneath the maxillipeds of *Pomacuma* is a grain of sand 0.25 mm. in diameter.

The operculum is differently formed in each of the genera.

A female example of *Zenocuma*, with the operculum in position (see fig. 7, A-D) has the joints of the first peracopods and third maxillipeds in the following relative positions.

The basis joints of the third maxillipeds meet completely in the midline, and form a vault or bridge in the form of a half-cylinder, tapering to the rear and open at the anterior end. The inner portions of the basis and ischium of the first peracopods overlap the outer edges of the maxillipedal vault; the lamellate inner portions of the carpal joints overlie the inner edges of the propodi; the outer edges of basis, merus and carpus lie against the infero-lateral folds of the carapace; the rounded inner proximal end of each carpus fits into the scooped outer face of the lobe of the ischium. The outer portion of each basis of the first peracopods is flanged, so that when it lies against the infero-lateral fold of the carapace a narrow ventral gutter results, tapering towards the front; the exopod of this limb, together with that of the third maxilliped, lies in and fills this gutter, the plumose setae being folded together like the hairs of a wet camel-hair brush. (In the figures the exopods are not shown in this position.)

The propodi of the first peracopods are placed together but are actually in contact only towards each end, a slight curvature of the joints leaving a narrow gap through which the first antennae may protrude (fig. 7, B and C).

In *Gephyrocuma* the relationship of third maxillipeds to first peracopods is much as in *Zenocuma* but the proximal thirds of the propodi of the first legs

curve against the peduncles of the first antennae which here are stout, swollen and geniculate, filling the gaps below the pseudorostral lobes (fig. 7, E), the flagella being thrust beneath the overhanging portions of the latter.

With the operculum in operation in both *Zenocuma* and *Gephyrocuma*, the dactylus with its setae, and the propodal setae (folded together like a fan) are all housed inside the maxillipedal vault, the anterior opening of which is plugged by the swollen distal ends of the propodi; the plumose geniculate palp of the third maxilliped is also covered by the inner lobe of the basis of that appendage.

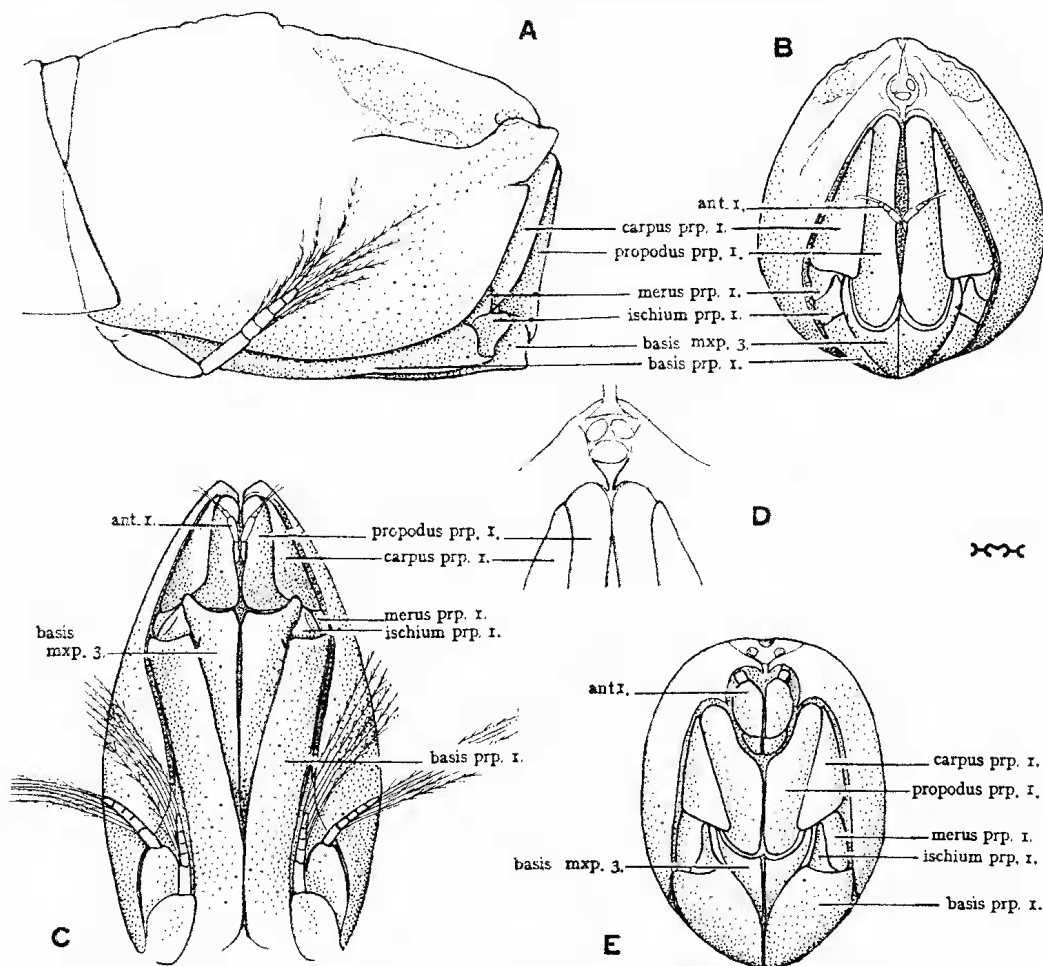


Fig. 7

Zenocuma rugosa, paratype female; A, B and C, carapace and appendages from side, front and below: in C, the body is tilted slightly upwards (x 26); D, oblique frontal view, below ocular lobe (x 45). E, Carapace and appendages of *Gephyrocuma fala* from the front (x 45).

As stated above, the basis of the first pereopod of *Pomacuma* differs from the other two genera in possessing a distal lobe, but that of the third maxilliped, though a good deal widened interiorly, lacks such lobe. In this genus the basis joints of the first legs meet intimately in the mid-line of the body for their whole length when the limbs are folded; they are closely applied to, and completely conceal, the shorter third maxilliped basis joints and project beyond them. Here the distal lobe of the basis of the first pereopod plays the same part as the maxillipedal lobe of the other genera, the anterior end of the propodus of the same

peraeopod fitting against it. As in *Zenocuma* and *Gephyrocuma* the exopods of the third maxillipeds and first peraeopod fit into a gutter between the basis joints of the last-named and the infero-lateral folds of the carapace; the palp of the third maxilliped is far less geniculate than in the others and is extended well forward, covered by the carpo-propodal part of the first legs.

Further modifications resulting from these arrangements will be noted in the descriptions and fig. 8 to 16. The three genera could be placed in a separate subfamily because of the character of the third and fourth thoracic appendages but, as described above, these are not really identical in all of them.

Genus *Zenocuma* nov.

Female. Form superficially as in *Vaunthompsonia* but integument rather highly calcified.

Carapace with pseudorostral lobes extending in advance of moderately large ocular lobe but diverging so that their anterior ends are well separated; antennal notch a closed, but not fused, slit. Five pedigerous somites exposed, the first short. Pleon as long as cephalothorax; telsonic somite subtruncate posteriorly the distal margin bisinuate and scarcely at all produced medianly.

First antenna normal, with accessory flagellum single-jointed. Second antenna relatively large, three-jointed, the two terminal joints subequal in length.

Mandible robust, with lacinia and molar process long and stout.

Second maxilliped slender, not at all expanded.

Third maxilliped with well-developed exopod; basis with an external distal lobe which almost reaches anterior end of merus and is furnished with a series of long, stout, plumose setae; interiorly the joint is greatly broadened, particularly distally where it sweeps forward to form a truncate arched lobe which is one-fourth as wide as total length of joint; there is a series of a dozen or so broad, tapering but short plumose setae on proximal half only of the inner margin. Remaining joints forming a geniculate "palp"; ischium short; carpus expanded in proximal half and propodus widened distally, the widened portions with series of long plumose setae; dactylus with plumose setae. (It is not possible to show all the setae in the drawings.)

First three pairs of peraeopods with well-developed exopods (peduncle and jointed flagellum); fourth with rudimentary single-jointed exopod capped with a few setae.

Basis of first peraeopod slightly expanded towards the anterior end which is subtruncate and a little excavate, rounded externally; there is a stout spine near distal end of inner margin and posterior to it, after an interval, is a row of other spines interspersed with plumose setae; ischium with inner lobe; merus articulating at outside of ischium; carpus expanded proximally with series of plumose setae.

Carpus of second peraeopod little shorter than merus.

Endopod of uropods two-jointed, the distal segment very short; inner margin of exopod with slender "serrate" spines.

Genotype *Zenocuma rugosa* sp. nov.

The male is as yet unknown. The female has the exopodal furniture just as in the related *Pomacuma* gen. nov., and *Leptocuma*, as recognised by the writer for six Australian species. In both of these and in *Gephyrocuma* Hale (which has essentially the same modification of third and fourth thoracic appendages as *Zenocuma*) the exopods do not differ in the sexes and there are five pairs of

pleopods in the male; one would be inclined to believe that this is the case in *Zenocuma* also, but the assumption cannot be accepted with any degree of confidence when Calman's *Leptocuma minor* is borne in mind (see notes under *Leptocuma* herein.)

(One species only is available.

***Zenocuma rugosa* sp. nov.**

Female. Carapace as seen from the side little arched but rugose for whole length, particularly in posterior half, owing to development of a median carina which is wide and fused-tuberculate and flattens out posteriorly; a rather deep dorsal excavation on each side of carina on anterior half, the lateral edges of which are tuberculate and the interior of which has one or two low tubercles; the

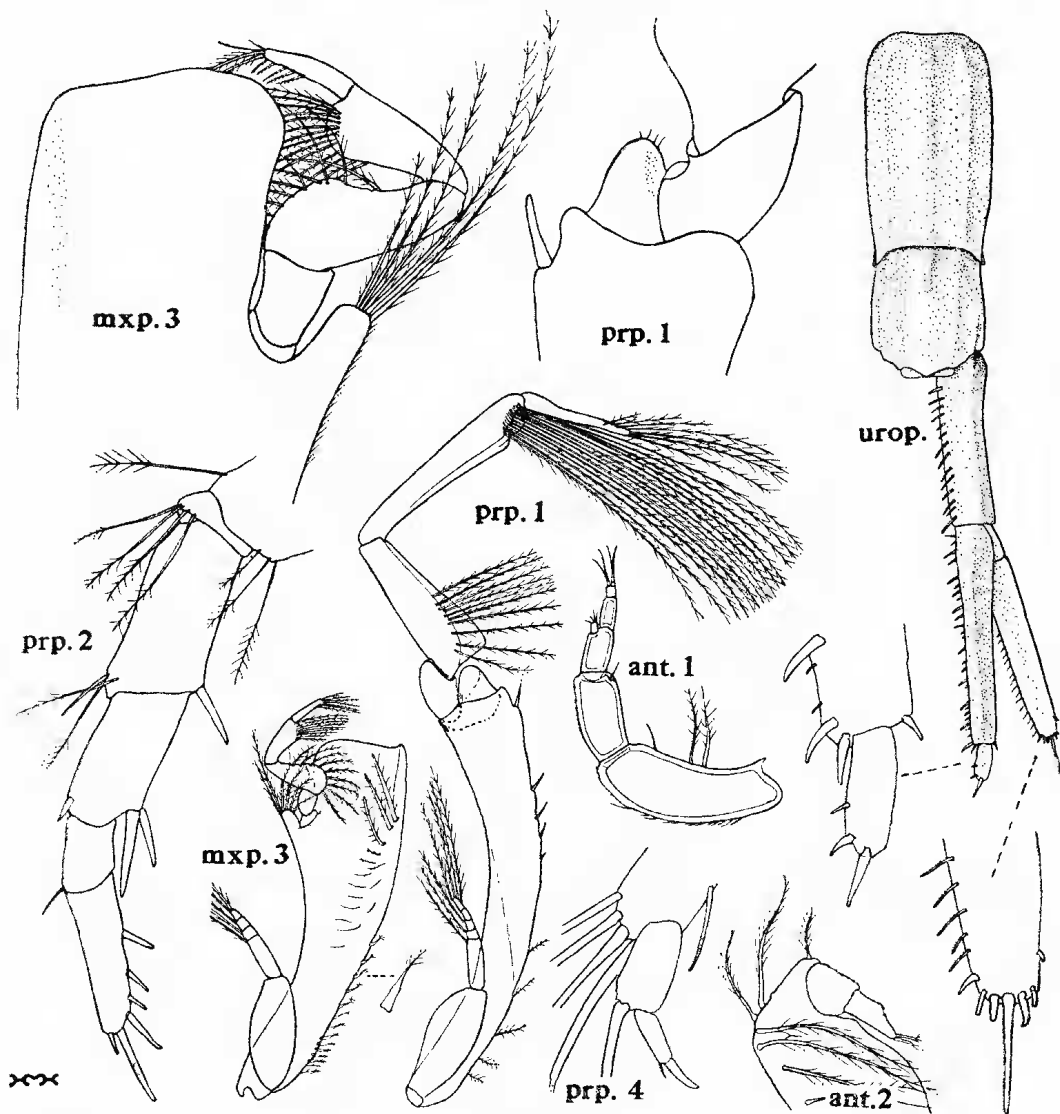


Fig. 8

Zenocuma rugosa, paratype female; third maxilliped and first peracopod (x 19); distal end of basis, etc. (x 50); ant. and prp., antennae and distal joints of second and fourth peracopods (x 50); urop., uropod, with fifth pleon and telsonic somites (x 19; distal ends of rami, x 62).

whole carapace is plump but compressed, less than half as long again as deep and a little longer than pedigerous somites together. Pseudorostrum shorter than ocular lobe; pseudorostral lobes subtriangular and narrowly rounded anteriorly when viewed either from above or from the side, just meeting at front of ocular lobe, then flaring outwards so that they are widely divergent; the inner parts in front of eye-lobe are bent downwards, producing a short longitudinal crease. Ocular lobe bilobed in front, about as wide as long, blackish, with lenses obscure but three can be discerned on each side and a central one still less defined.

Pedigerous somites two to five elevated on posterior half when viewed from side; first smooth; dorsum of second with a faint transverse elevation and a pair of longitudinal carinae; back of third to fifth with a transverse ridge (that of third with a pair of median tumidities) which joins a faint longitudinal dorso-lateral ridge; on the fifth, and still less distinctly marked on fourth, is a lateral ridge just below the dorso-lateral; the second somite, as usual in the group, overlaps the carapace in front and is in turn over-ridden by the anterior pleural portions of the third; posterior pleural parts of third and fourth produced backwards in the form of a large rounded lobe.

Each of pleon somites one to five with on each side a dorso-lateral carina, two lateral carinae and an infero-lateral ridge; these are least pronounced on first and second, then become conspicuous; there is in addition a median dorsal carina which is not well defined until the third somite, thence to the fifth it is distinct; telsonic somite with median carina on proximal third only, also a dorso-lateral and a lateral ridge on each side; it is not much longer than wide, not much more than half as long as fifth pleon somite, with posterior margin bisinuate on each side, scarcely produced and widely triangular in the middle.

First joint of peduncle of wide superior antenna as long as second and third joints together with flagellum; second joint nearly twice as long as third; flagellum two-jointed, the first segment more than twice as long as second.

Second antenna relatively large, its terminal joint subconical, longer than second and with well-developed apical sensory appendages.

Mandible with ten or eleven spines in the row, successively stouter from in front backwards; molar process as long as distal portion of trunk anterior to it.

Basis of third maxilliped twice as long as palp if stretched out, its greatest width nearly one-third of its length; carpus distinctly more than twice as long as merus and one-third as long again as propodus; dactylus little longer than merus.

First peraeopod with basis much shorter than rest of limb; propodus more than one-third as long again as carpus and nearly twice as long as dactylus; distal plumose brush of propodus equal in length to propodus and dactylus combined.

Second peraeopod with basis stout, not as long as remaining joints together; carpus equal in length to dactylus, not much shorter than merus, and more than twice as long as propodus; dactylus with four stout spines on inner margin (the first and last a little larger than the middle two) and two very unequal distal spines, the longer almost half as long as the joint; the figure shows the other stout and slender spines, and plumose setae.

Third to fifth peraeopods stout; basis of third subequal in length to remainder of limb, that of fourth and fifth only half as long or less; carpus with four strong distal fossorial setae (as well as a comb of short setae) which with propodal seta reach well beyond the blunt dactylar claw, which has a short outer seta at its base.

Uropod with peduncle and endopod strongly ridged longitudinally, the former a little longer than telson and two-thirds as long as endopod, which is more

than one-eighth longer than exopod; its inner margin bears spines which are mostly of the same size; first joint of endopod more than five times as long as second, with an inner row of unequal spines and a single spine at outer distal corner; second joint of endopod with only one inner spine and with two or three unequal spines at rounded apex; exopod with a row of slender compound ("serrate") spines on inner margin followed by a single short strong spine and four or five which may be regarded as apical, one being much longer than the others; on outer margin near apex is a single small spine.

Colour cream or dark orange-yellow with brown chromatophores on carapace, and a darker brown marking at each postero-lateral corner of excavation on back of carapace; eye black; very fine chromatophores on pleon. The portions

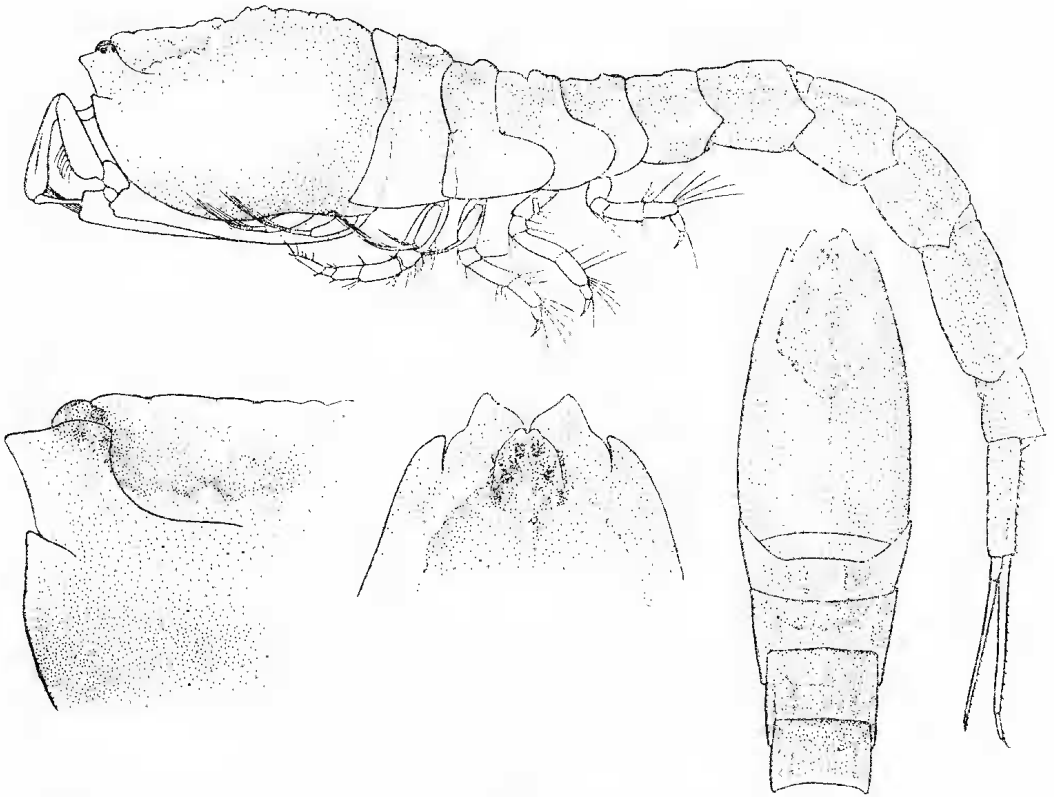


Fig. 9

Zenocuma rugosa, type female; lateral view and cephalothorax from above (x10); anterior part of carapace from the side and from above (x20).

of the first pereopods and third maxillipeds exposed when the operculum is in position are boldly mottled with dark brown.

Length, 14.5 mm.

Loc.—New South Wales: off Gibbon, 35 fath., in coarse sand (K. Sheard, Feb. 1940); off Eden, 30 metres, trawled in coarse sand (K. Sheard, Oct. 1943); Ulladulla, 75 metres, trawled in sand (*type loc.*, K. Sheard, June 1944). Type female in South Australian Museum, Reg. No. C.2535.

At each of the above localities this form was taken in company with *Pomacuma australiac*, as well as a dozen or more other species of Cumacea; it stands out from *Pomacuma*, not only by its larger size, but because of the gaping pseudorostral lobes, subtruncate telsonic somite, unequal rami of the uropods, etc.;

the jutting basis of the third maxilliped is also very apparent when the anterior appendages are partly opened, as they often are in preserved material (fig. 9).

Genus *Pomacuma* nov.

Female. Form superficially as in *Vaunthompsonia*; integument little calcified.

Carapace with pseudorostral lobes extending in front of moderately large ocular lobe and meeting in the mid-line; antennal notch, as in *Zenocuma*, a closed slit. Five pedigerous somites exposed, the first short. Pleon longer than cephalothorax; telsonic somite well produced posteriorly, the distal margin rounded.

First antenna normal, with accessory flagellum single-jointed. Second antenna three-jointed, like that of *Zenocuma*.

Mandible with long lacinia and long, stout molar process.

Epipod of first maxilliped with a dozen or more wide lamellate gill-lobes with thickened edges.

Second maxilliped slender.

Third maxilliped with well-developed exopod; basis with a short external distal lobe bearing a fan of plumose setae; the joint is widened interiorly and is truncate distally but is not forwardly produced; there is a series of plumose setae on the whole length of inner margin, the distal ones about as long as those of external lobe; remaining joints much as in *Zenocuma*, but the palp is rather less markedly geniculate (full series of plumose setae not shown in figures).

First three pairs of peraeopods with well-developed exopods; fourth pair with rudimentary single-jointed exopod capped with a few setae.

Basis of first peraeopod widened distally where a large forwardly directed lobe is produced interiorly ("Oberseite" of Zimmer) reaching to the level of anterior end of oblique articulation of ischium and merus; remaining joints as in *Zenocuma* and *Gephyrocuma*.

Carpus of second peraeopod much shorter than merus.

Endopod of uropod two-jointed, the distal segment very short; inner margin of exopod with plumose setae.

Male. Pleon relatively slightly longer than in female.

Second antenna reaching to end of pleon, the longest joints of flagellum only half as long again as wide.

Thoracic exopods as in female. Five pairs of pleopods.

Genotype *Pomacuma cognata* sp. nov.

This genus is related to *Zenocuma* but the important differences in the structure of the basis of the third maxilliped and first peraeopod, and in the pseudorostrum and telsonic somite are very apparent without dissection.

It may be noted also that *Pomacuma* has plumose setae on the whole of the inner margin of the basis of the third maxillipeds, and they are of different type from those occurring on proximal half only in *Zenocuma*; further, this basis, although less expanded than in the last-named genus, still is about one-fourth as wide as long owing to its relative shortness due to absence of a distal lobe; it does not project beyond the anterior end of basis of the first peraeopod.

Two well defined species are available from off eastern Australia. One of these, excepting for a few trivial differences, closely resembles Zimmer's Western *Vaunthompsonia* (?) *australiae* and so is referred to that species; in any case *australiae* is undoubtedly congeneric with *cognata*.

KEY TO SPECIES OF POMACUMA

Carpus of third maxilliped more than half as long again as propodus. Dactylus of second peraeopod more than three times as long as propodus and with ten spines on inner margin. Uropod with peduncle equal in length to first joint of endopod and with a row of spines on distal third of outer margin of exopod. Pleon ridged *cognata* sp. nov.

Carpus of third maxilliped less than half as long again as propodus. Dactylus of second peraeopod less than three times as long as propodus and with only about seven spines on inner margin. Uropod with peduncle distinctly shorter than first joint of endopod and with no long row of spines on outer margin of exopod. Pleon smooth *australiae* (Zimmer)

Pomacuma cognata sp. nov.

Ovigerous Female. Integument glossy, with very fine reticulate pattern and superficial pitting.

Carapace as seen from side slightly arched dorsally; it is half as long again as deep and not quite as long as pedigerous somites together; the outline is rugose

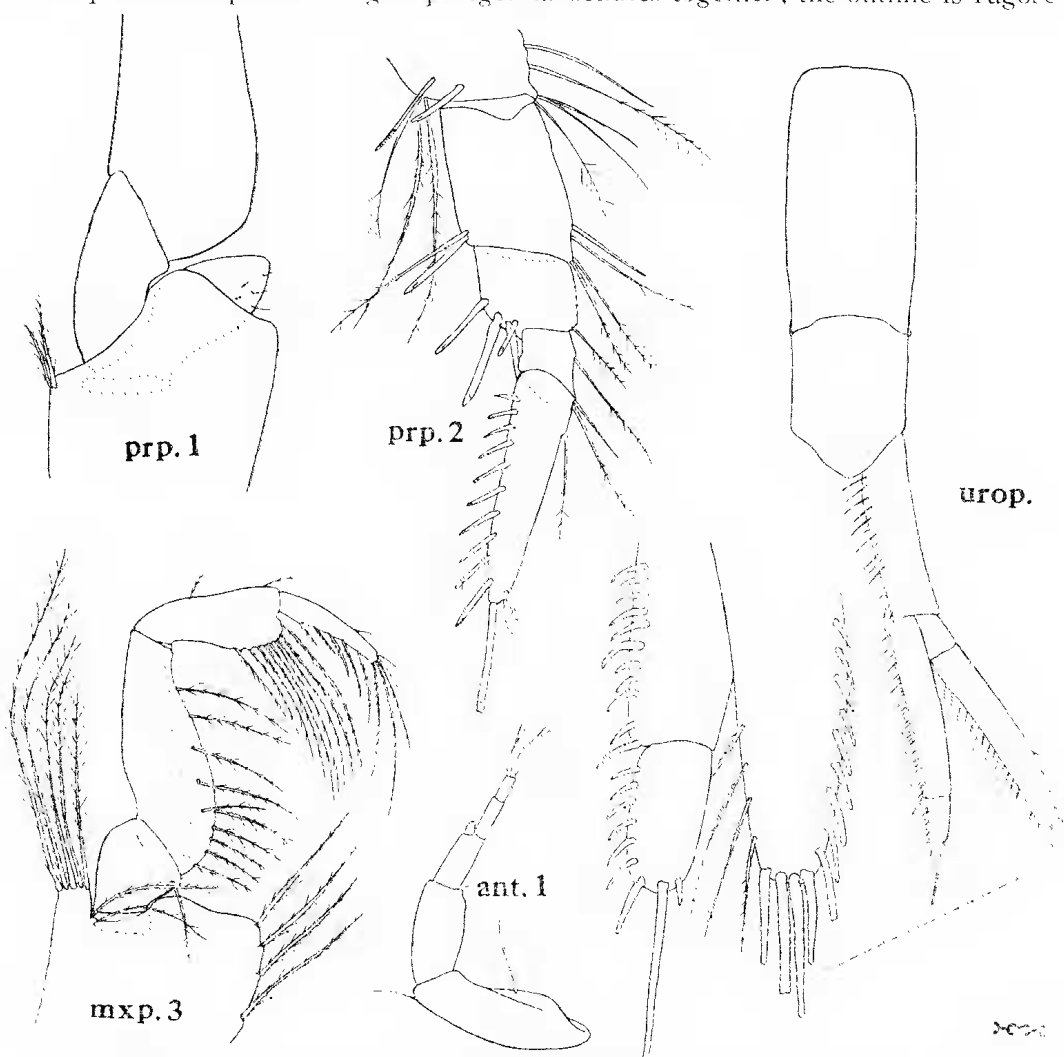


Fig. 10

Pomacuma cognata, type ovigerous female; ant. 1, first antenna ($\times 86$); mxp. 3, palp and distal end of basis of third maxilliped ($\times 86$); prp. 1, merus, ischium and distal end of basis of first peraeopod ($\times 86$); prp. 2, second peraeopod, basis not shown ($\times 86$); urop., uropod, with fifth pleon and telsonic somites ($\times 26$; distal half of rami, $\times 80$).

in posterior half owing to the tuberculation of a well-developed median carina, which is flanked on each side in anterior half by a depression; the latter has tuberculate edges and inside it are two rows of ill-defined large tubercles; sides with sparse, small low rounded tubercles. Pseudorostral lobes each slightly produced in front, so that pseudorostrum has a somewhat pointed appearance. Ocular lobe as wide as long, black with the corneal lenses not easily made out.

Pedigerous and pleon somites with sculpturing essentially as described for *Zenocuma rugosa* but not so strongly marked. Telsonic somite nearly half as long again as wide and less than two-thirds as long as fifth pleon somite; its produced posterior part comprises one-fourth of its length.

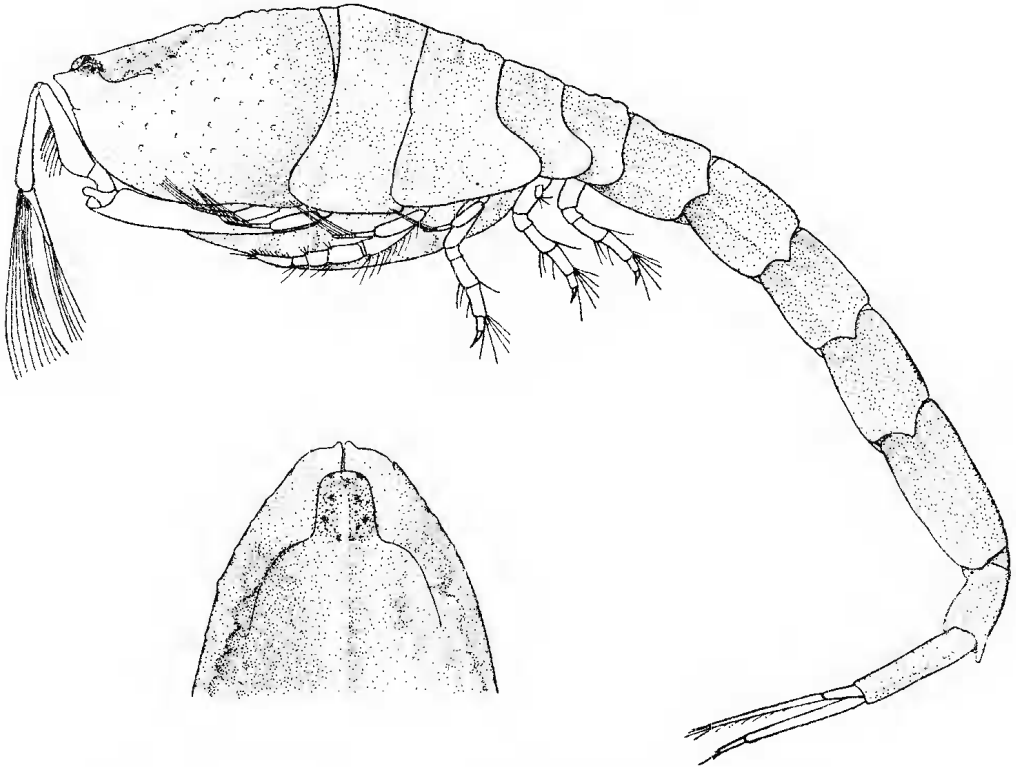


Fig. 11

Pomacuma cognata, type ovigerous female; lateral view (x 17) and anterior part of carapace from above (x 46).

First joint of upper antenna nearly twice as long as second which is more than half as long again as third and longer than the stout two-jointed flagellum.

Third joint of second antenna capped with short but well developed sensory appendages.

Mandible with about 17 spines in the long row.

Carpus of third maxilliped nearly two and two-thirds times as long as merus, fully two-thirds as long again as propodus and more than twice as long as dactylus.

First peraeopod much as in *australiac*, but with joints of slightly different proportions.

Dactylus of second peraeopod distinctly more than three times as long as propodus, two and two-thirds times as long as carpus, and almost half as long again as merus; its inner margin bears a row of ten spines (see note under

australiae), and distally it has a long spine and a shorter one; other furniture is shown in the figure of this limb.

Posterior peraeopods robust, with four stout distal carpal setae reaching well beyond tip of dactylus.

Uropod with peduncle as long as first joint of endopod and with a row of spaced spines on inner edge; endopod equal in length to exopod, with first joint almost four times as long as second and with many unequal, closely-set spines on inner margin; longer terminal spine of second segment distinctly longer than the latter; rounded distal end of exopod with four slender blunt-ended spines and outer margin with nine spines on distal third, successively increasing in length from first backwards.

Colour, biscuit brown with darker indefinite shadings.

Length, 8 mm.; ova, 0.28 mm. in diameter.

Loc.—New South Wales: off Coffs Harbour, 30° 18' S., 153° 16' E., 50 metres (K. Sheard, June 1941). Type in South Australian Museum, Reg. No. C.2482.

This species turned up only once in the hauls made off eastern Australia which may indicate that it is not so abundant there as is the second species referred to the genus.

POMACUMA AUSTRALIAE (Zimmer)

Vaunthompsonia (?) *australiae* Zimmer, 1921, 4, fig. 1-7.

Leptocuma australiae Hale, 1936, 409.

Female. Integument glossy with very fine reticulate pattern.

Carapace seen from the side almost evenly arched dorsally, very slightly sinuate on posterior half; median carina distinct, clear cut in front half, where on each side is a smooth, shallow but quite apparent excavation; sides smooth; it is plump, as wide as deep, less than half as long again as depth and barely as

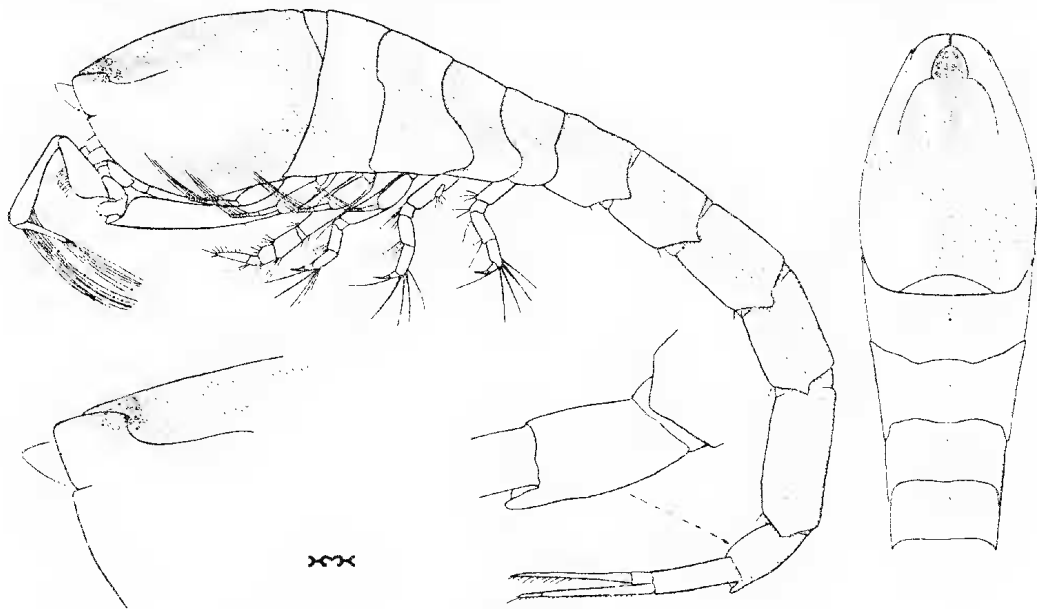


Fig. 12

Pomacuma australiae, female: lateral view and cephalothorax from above ($\times 15$); telsonic somite and anterior part of carapace from the side ($\times 36$).

long as pedigerous somites together. Pseudorostral lobes roundly and obliquely subtruncate in front, not at all pointed and meeting in advance of eye-lobe for a distance equal to barely half the length of the latter. Ocular lobe as long as wide, rounded in front, very slightly constricted at base, black, with eye lenses apparently as described by Zimmer but their definition confused by pigment.

Pedigerous and pleon somites smooth, rounded.

Telsonic somite rather less than half as long again as wide and less than two-thirds as long as fifth pleon somite which is only slightly narrowed towards the rear; produced distal portion fully one-fourth of total length of somite.

Antennae as in *cognata*.

Basis of third maxilliped more than half as long again as palp when fully extended; carpus barely more than twice as long as merus, not quite half as long again as propodus, and about twice as long as dactylus.

Basis of first peracopod as long as rest of limb, with plumose hairs on outer edge including distal end (two or three) and with spines and plumose setae on inner edge, leaving distal part and lobe unarmed; ischium, including lobe, about as long as merus; propodus more than half as long again as carpus and twice as long as dactylus.

Dactylus of second peracopod about two and one-third times as long as propodus, less than twice as long as carpus and scarcely longer than merus; its inner margin bears a row of five to seven spines, and there is a long distal spine and a short one; other furniture see figure.

Posterior peracopods robust, with four distal carpal setae which with propodal seta reach well beyond tip of dactylus.

Uropod with peduncle six-sevenths as long as first joint of endopod and with a few spines on inner margin; endopod equal in length to exopod, its first joint nearly five times as long as second, with short spines on inner margin, interspersed with longer spines; second joint, as in *cognata*, with a row of inner spines which successively increase very slightly in length, but with the longer terminal spine of the rounded distal end shorter than the joint; apex of exopod with three or four blunt, stout, very unequal spines and with only one small, stout, subdistal spine on outer margin.

Colour translucent, with brown chromatophores which are often massed to form an irregular pattern, the most consistent markings being situated at the posterior ends of dorsal excavation of carapace. Sometimes the second and third pedigerous somites have the back brown and a brown patch on each pleural part, while the posterior half of the first pleon somite is darkened. The eye is always bluish-black.

Length, subadult, 8.7 mm.

Adult Male. The same slight irregularity of the dorsal contour of the carapace is present, but is barely discernible. First antenna of slightly different proportions (second peduncular joint twice as long as third, as shown by Zimmer), with flagella more robust and generously furnished with sensory setae; the main flagellum appears to be three-jointed, but the last "joint" may, as surmised by Zimmer, represent the bases of the terminal sensory appendages. The last joint of the peduncle of the second antenna is fully two-thirds as long again as the penultimate; the proximal joints of the flagellum are as wide as long, or wider, but soon become relatively more elongate but never very much so as in *L'aunthompsonia*.

The uropods differ from those of the female in having a greater number of marginal spines (second series well developed on peduncle), those of the second

endopodal joint being interspersed with smaller spines, etc.; the plumose hairs on the exopod are longer and the distal spines of that ramus a little more robust.

Length, 9 mm.

Loc.—Queensland: off Fraser Island, 24° 20' S., 153° 02' W. ("Warreen" Station 31, Sept. 1938). New South Wales: off Broughton Island, at surface (D. L. Serventy, midnight, Dec. 1938); off Jibbon, 35 fath., in coarse sand (K. Sheard, Feb. 1940); off Wata Mooli, 70 metres ("Cronulla" Trawl Station 4, July 1943); off Eden, 30 metres, trawled in coarse sand (K. Sheard, Oct. 1943); Ulladulla, 75 metres, trawled in sand (K. Sheard, June 1944).

Hab.—North-Western and eastern Australia.

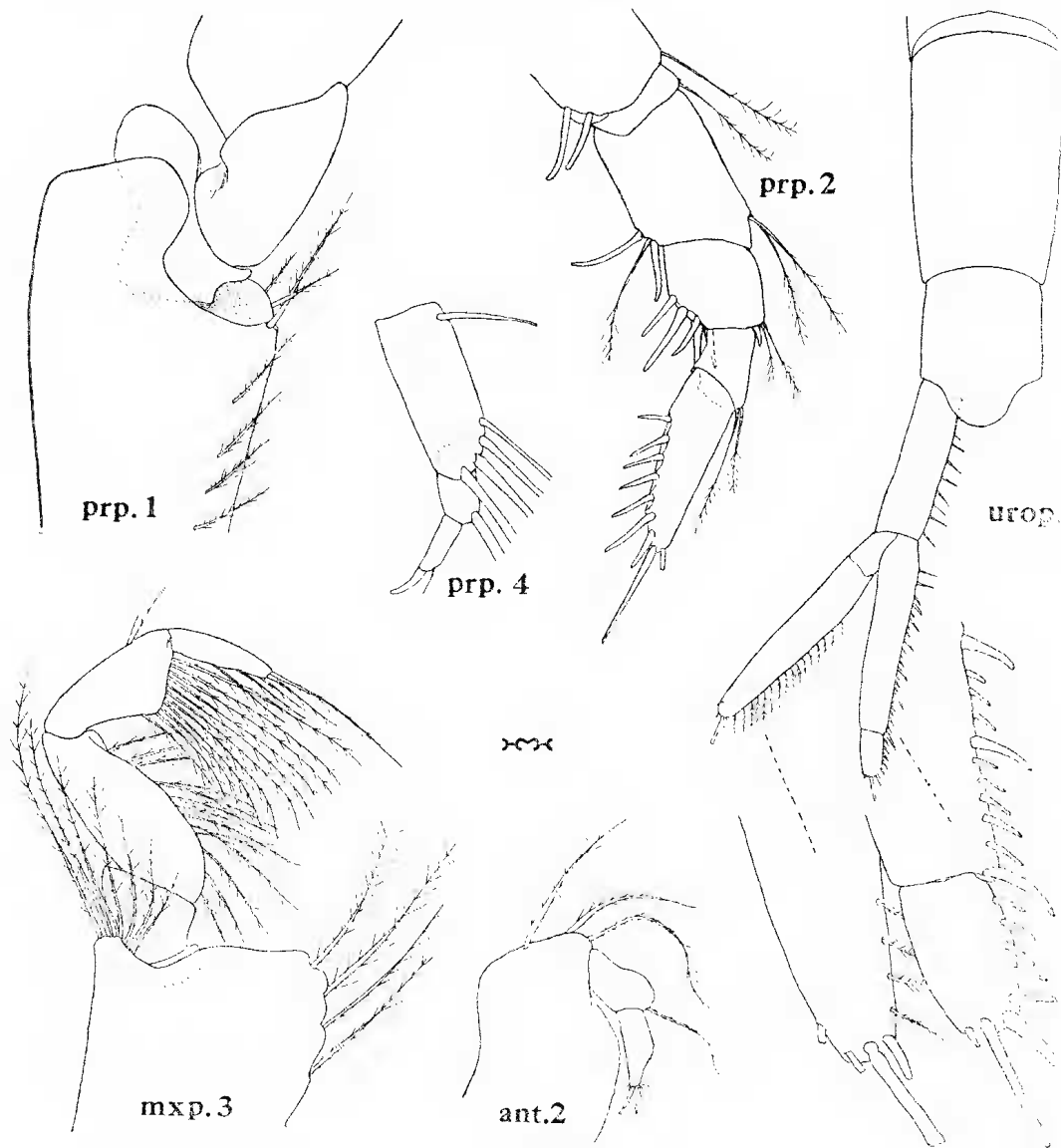


Fig. 13

Pomacuna australiac, female; ant. 2, second antenna; mxp. 3, palp and distal end of basis of third maxilliped; prp. 1, merus, ischium and distal end of basis of first peraeopod; prp. 2, second peraeopod, basis not shown; prp. 4, distal joints of fourth peraeopod (all $\times 86$); urop., uropod with fifth pleon and telsonic somites ($\times 26$; distal half of rami, $\times 100$).

Zimmer regarded his species as representative of a new genus because of the structure of the third maxilliped and first peracopod. He did not dissect his single young male, but illustrates the basis of this maxilliped as truncate at the level of the insertion of the palp. Although he shows the dorsal margin of the carapace as perfectly smooth, there is little doubt that the eastern specimens are correctly referred; the proportions of the joints of third maxillipeds and peracopods, as far as shown, seem much the same, and there are six inner spines on the carpus of the second legs. There are, however, some differences; Zimmer states that the

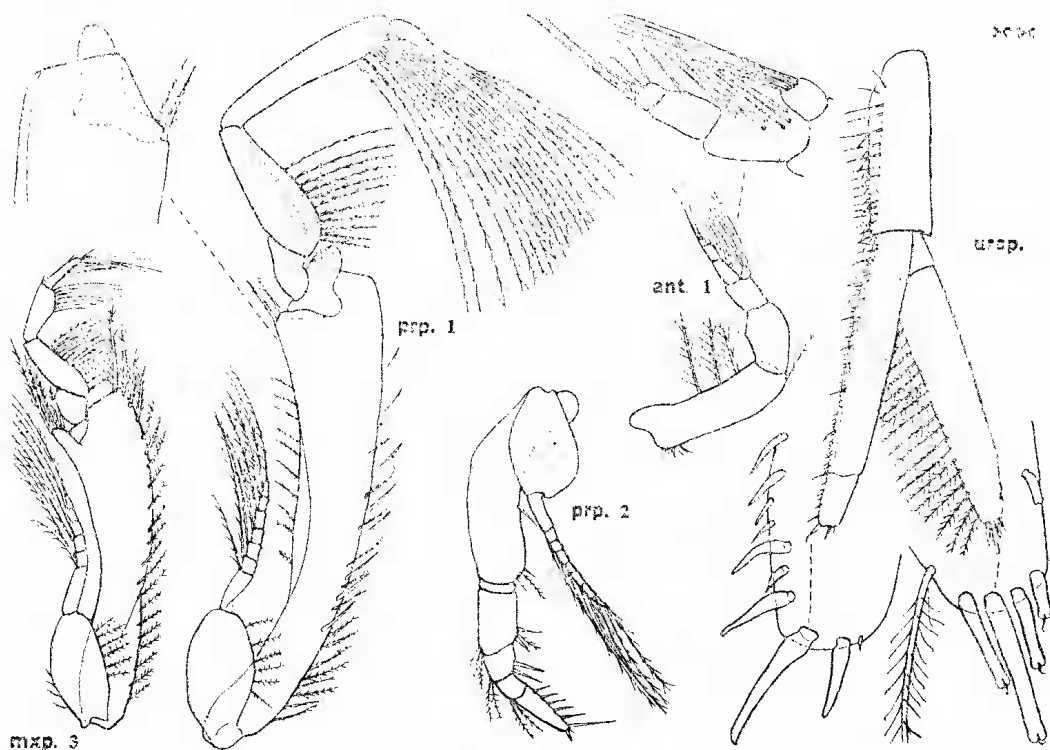


Fig. 14

Pemacuma australiac, adult male; ant. 1, first antenna (x 52; flagella, x 170); mxp. 3, third maxilliped (x 32); prp., peracopods (x 32); lobe of basis of first, x 52; urop., uropod; apices of rami (x 170).

telsonic somite is not much produced posteriorly and shows it as so in his fig. 7; also, he figures three small subapical spines on the outer margin of the uropodal exopod. He remarks incidentally the characteristic blunt terminal spines of this ramus, which differ slightly from those of *coquula*. The several types of composite setae and other projections occurring in Cumacea, and loosely referred to as "spines" for taxonomic purposes, are worthy of special studies such as have been applied elsewhere.

Genus GEPHYROCUMA Hale

Gephyrocuma Hale, 1936, 412; and 1943, 340.

Ocular lobe wide and not distinctly separated off from frontal lobe; lenses very large. Antennal notch so widely open that no distinct incision or antennal angle is evident.

Pleon reduced, at most only about two-thirds as long as cephalothorax in the male, shorter in the female.

First antenna strongly geniculate, with joints of peduncle globose. Second antenna of female indistinctly three-jointed, the third segment elongate and with a minute terminal jointlet (fig. 17, ant. 2).

Basis of third maxillipeds without external apical lobe but with very large inner lobe.

Basis of first peracopod distinctly twisted, with no distal inner lobe.

Exopods of peracopods identical in both sexes; well developed on first and second pairs, and rudimentary on third and fourth. On the third pair the exopod is either single-jointed, or with peduncle and first joint only of flagellum developed.

Uropods with short peduncle and with endopod two-jointed, the first segment much longer than the second.

KEY TO SPECIES OF GEPHYROCUMA

Exopod of third peracopod with two joints. Endopod of uropod without spines on inner margin *pala* Hale

Exopod of third peracopod single-jointed. Endopod of uropod with a row of spines on inner margin *repanda* sp. nov.

Gephyrocuma repanda sp. nov.

Adult Male. Integument thin and fragile, somewhat polished.

Carapace as seen from the side with dorsal margin evenly and slightly convex; little more than one-third of total length of animal; twice as long as depth, which is equal to the width; dorsal carina scarcely apparent. Pseudorostral lobes meeting in front of the ocular lobe for a distance equal to about one-third of the length of the latter; wide and truncate anteriorly. Ocular lobe much broader than long, with nine large lenses, five of which, together with the greater part of the lobe, are pigmented. Margin below front of pseudorostral lobes slightly concave.

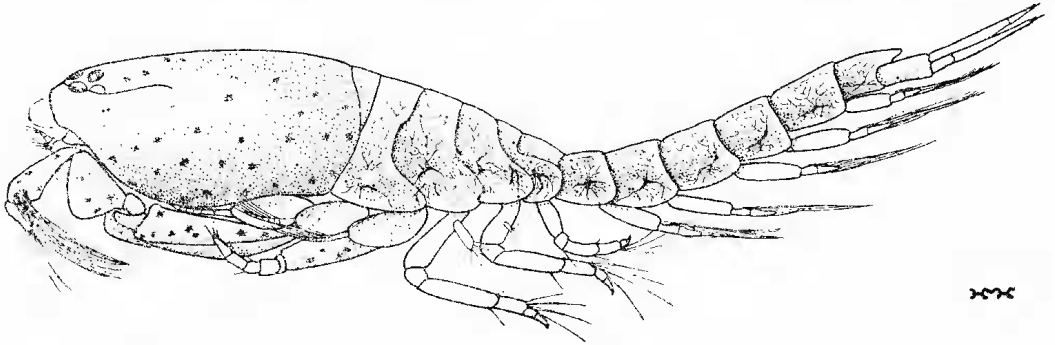


Fig. 15

Gephyrocuma repanda, type adult male (x 32).

Pedigerous somites all exposed, together two-thirds as long as carapace; first somite short, concealed on sides; postero-lateral portions of each of second, fourth and fifth somites produced backwards as a rounded lobe; second to fourth not differing markedly in length.

Pleon more than two-thirds as long as cephalothorax; third to fifth somites somewhat deeper than the others.

First antenna very stout; joints of peduncle almost globose, the diameter in the second and third being equal to the length; first segment of peduncle as long as rest of appendage; flagellum three-jointed and accessory flagellum small, stout and knob-like.

Second antenna long, the flagellum reaching beyond end of telson.

Epipod of first maxilliped with four stout digitiform gill-lobes, two of which are smaller than the others.

Basis of third maxillipeds with width of inner lobe equal to one-third of length of joint; two short plumose setae on inner edge; the carpus of the extended geniculate palp does not quite reach level of distal end of basis.

First peraeopod with its massive basis distinctly longer than rest of limb; carpus a little shorter than propodus, its greatest width two-thirds its length; dactylus short and stout, less than half as long as propodus.

Basis of second peraeopod three times as long as wide, more than half as long again as remainder of limb; ischium distinct; merus as long as dactylus and longer than carpus or propodus, the last-named, nevertheless, not much shorter than the dactylus; the dactylus has three rather stout distal spines.

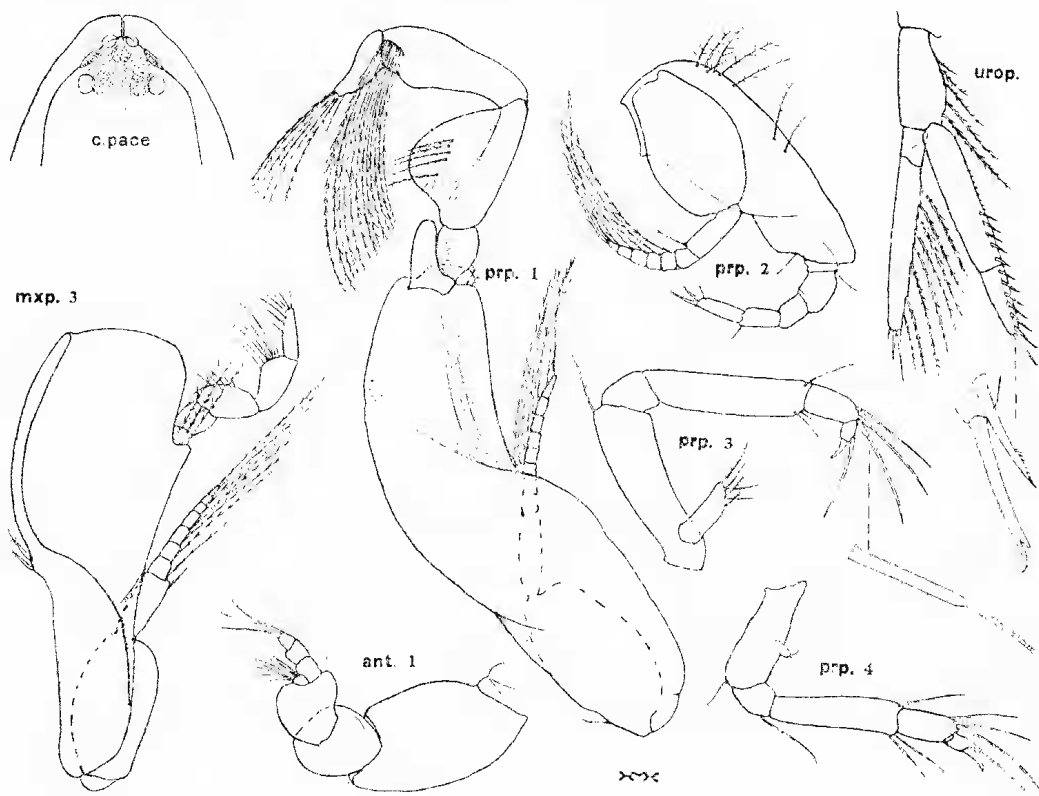


Fig. 16

Gephyrocuma repanda, paratype adult male; c. pace, anterior portion of carapace (x30); ant. 1, first antenna (x155); mxp. 3, prp. and urop., third maxilliped, peraeopods and uropod (x75; spines and seta, x330).

Merus of third peraeopods barely shorter than basis, that of fourth and fifth pairs much longer than basis; propodi and dactyli short and stout; three distal carpal setae, the longest reaching well beyond tip of dactylus; exopods of third and fourth legs rudimentary, without trace of flagellum (fig. 17, B).

Peduncle of uropods stout, only about half as long as exopod and with a row of long plumose setae on inner margin; endopod a little longer than exopod; its first joint is more than twice as long as the second and its inner margin bears spinules and, on the distal half, a row of short stout spines; second joint with an

inner row of half-a-dozen stout spines and with a terminal spine; exopod with three unequal apical spines and a row of long plumose setae on inner margin (fig. 17, B).

Colour translucent with orange chromatophores (artificial lighting), which appear black after preservation, arranged as shown in fig. 15.

Length, 3.25 mm.

Juvenile Male. The pleon is shorter than in the adult male, but is much longer than the pedigerous somites together.

Length, 2 mm.

Non-ovigerous Female. The pleon, though relatively smaller than in the adult male, is much longer than the pedigerous somites together.

Length, 2.5 mm.

Loc.—New South Wales: Cronulla, 8 feet, on coarse sand (*type loc.*; H. M. Hale and K. Sheard, submarine light, Sept. 1942 and Jan. 1944); Port Hacking, 50 metres, on coarse sand (K. Sheard, June 1943); off Wata Mooli, 35 metres, on sand ("Cronulla" Trawl Station 2, July 1943); Jibbon, 45-50 metres, on coarse sand ("Cronulla" Trawl Station 10, Aug. 1943); Ulladulla, 75 metres (K. Sheard, trawled, July 1944). Type male in South Australian Museum, Reg. No. C.2474.

Most of the examples are adult males secured at Cronulla; the single female was taken off Jibbon.

In fig. 15 the concavity shown in the outline of the carapace below the pseudo-rostrum is that into which the carpo-propodal articular areas of the first peraeopod fit when the operculum is in operation. The projecting distal end of the basis of the third maxilliped may be seen below the ischio-carpal part of the first leg; this is even wider than in the genotype, as is also the carpus of the first peraeopod. The carpus and propodus of the first leg accordingly form a wider angle when folded, the triangular lamellate part of the carpus overlapping slightly the outer distal portion of the maxillipedal lobe; the peraeopod fits so intimately against the maxilliped that it is not easy to detect the margins.

The fragile integument collapses on partial drying.

GEPHYROCUMA PALA Hale

Gephyrocuma pala Hale, 1936, 412, fig. 5-6; and 1934, 340, fig. 8-9.

This, the genotype, apart from the smaller size, shows many constant differences from the New South Wales species.

Male. The pleon is shorter, at most barely longer than the pedigerous somites together. The subconical accessory flagellum of the first antenna is larger. The distal spines of the second peraeopods are longer, and are four in number, while the exopods of the third and fourth legs are much larger, that of the third pair consisting of two joints, peduncle and first segment of the flagellum. The distal spines of the rami of the uropods are not so stout; the second joint of the endopod is more than half as long as the first, and neither segment has spines on the inner margin (cf. A and B in fig. 17).

Both species have up to five short and stout plumose setae on the inner margin of the basis of the third maxilliped.

Ovigerous Female. Much as previously described for the subadult of this sex, and differing from *repanda* as above. The pleon is barely as long as the pedigerous somites together. The flagellum of the first antenna is two-jointed.

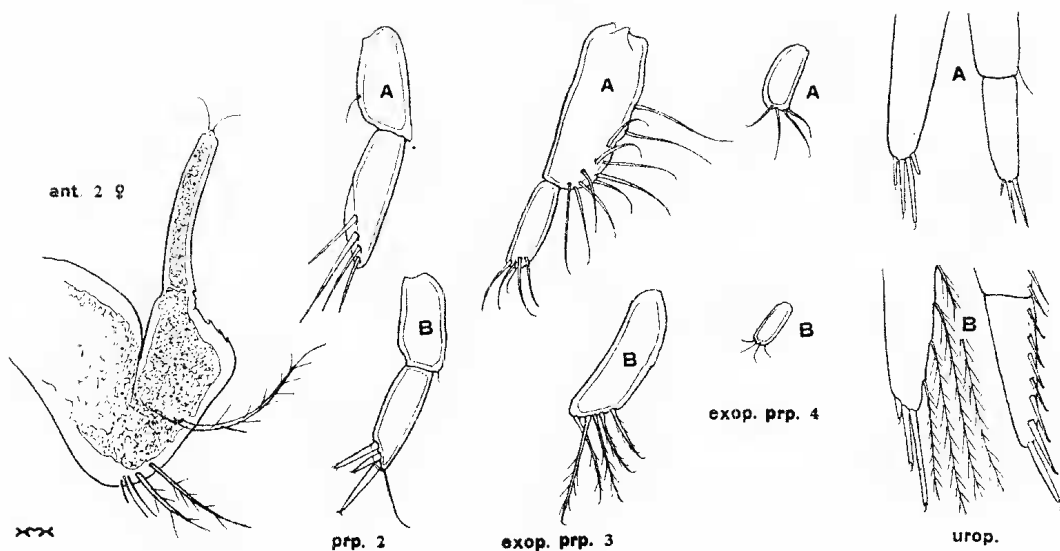


Fig. 17

ant. 2, Second antenna of female of *Geophyrocuma pala* (x 280). prp. 2, exop. prp. 3-4 and urop. Distal joints of second peraeopods and distal half of rami of uropod of (A) *Geophyrocuma pala*, (B) *G. repanda* (x 140).

The ova are relatively very large, 0.2 mm. in diameter or about one-third the greatest depth of the body.

Length, 2.3 mm.

Loc.—This species occurs on sandy beaches in St. Vincent Gulf, South Australia, sometimes in great numbers, but for long periods may be absent or rare.

Genus LEPTOCUMA Sars

Leptocuma Sars 1873, 24; Stebbing 1913, 53 (syn.).

The genotype (*L. kinbergii*) was described from the female; it and two females subsequently identified with the species (Calman 1907, 30; and 1912, 616) were taken in the South Atlantic. Calman also referred to the genus a species (*minor* Calman 1912, 616, fig. 14-20) from the North Atlantic, and the female of this would seem to be congeneric with Sars' species; the male of *minor* has only three pairs of pleopods, and exopods are well developed on the first four pairs of peraeopods. Later, the present writer tentatively placed in the genus two Australian species (*pulleini* and *sheardi*); the females of these also cannot be satisfactorily separated generically from *kinbergii* as described by Sars, but the males have five pairs of pleopods and the exopod of the fourth peraeopod rudimentary as in the female.

Vaunthompsonia (?) *australiac* Zimmer was also temporarily referred to *Leptocuma* (Hale 1936, 408), but has been shown above to belong elsewhere.

Four further species, congeneric with *pulleini* and *sheardi*, perhaps congeneric with *kinbergii*, but certainly not with *minor*, are now described.

All six Australian species differ from *minor* in the following characters also. The pseudorostral lobes, as in *Vaunthompsonia*, extend a little in front of the ocular lobe but do not meet. The mandibles are robust and have a dozen or more spines ("only about six" in *minor*). The branchial lobes are thin and leaf-like and are much more numerous (eleven to nineteen plus one reflexed instead of about seven plus one). The basis of the third maxilliped is not at all produced distally, but on the contrary the external angle is rounded and slopes backwards;

the fan of distal plumose setae is arranged in two series, only one of which is shown in fig. 18. In the pleopods there is no narrow process on the outer margin of the endopod. Only a fuller description of the genotype will clarify the situation.

The Australian species apparently agree with both *kinbergii* and *minor* in the structure of the second peraeopods, which are unusual in that there is a brush of distal setae on the propodus and dactylus, but no spines. The first antennae have the accessory flagellum single-jointed. The second antenna of the female is three-jointed (the first and largest joint itself indistinctly divided). The telsonic somite is well produced posteriorly and its apex is rather angular. In the third maxillipeds the ischium is short and the merus is not as long as the carpus.

The second antennae of a large but subadult female of *vicaria* sp. nov., as shown in fig. 18, B. juv., are not distinctly divided into joints, whereas in ovigerous females (fig. 18, A and B) there is a long basal joint (indefinitely divided into two) and the last of the other two joints is conical and longer than the second.

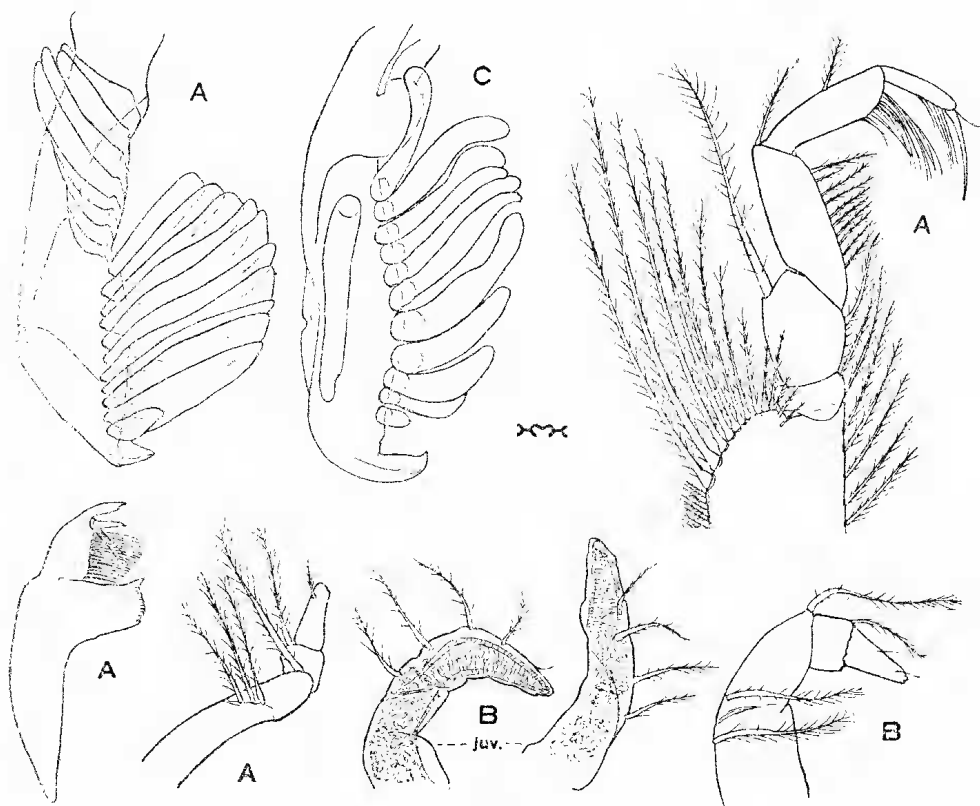


Fig. 18

Leptocuma, branchial apparatus, distal part of third mandible, and female second antennae; maxilliped: A, *pulleini*, ovigerous female; B, *vicaria*; C, *sheardi*, adult male.

The ocular lobe is wide, moderate or large in size. The joints of the flagellum of the second antenna of the male are elongate.

The integument, as in *Vaunthompsonia*, is scarcely calcified. The third somite of the female is produced forward on each side to form a lobe overlapping the second, and the antero-lateral parts of the fourth somite of the male are similarly expanded to override the third.

The Australian species fall into two well-defined sections, the differences being detailed in the following key.

KEY TO AUSTRALIAN SPECIES OF *LEPTOCUMA* (ADULTS)

- 1 First peracopod with a prominent *simple* spine at distal end of inner margin of basis, preceded by several shorter spines, and with a well-developed brush of setae at distal end of propodus. Setae of third to fifth peracopods very numerous. Uropod with first joint of endopod shorter, or barely longer, than second. Over 13 mm. in length. 2
- First peracopod with a *serrate* spine at distal end of inner margin of basis, preceded by one longer spine, also serrate; with sparse setae at distal end of propodus. Setae of third to fifth peracopods not very numerous. Uropod with first joint of endopod much longer than second. Less than 8 mm. in length. 3
- 2 Second peracopod reaching to or beyond distal end of basis of first leg, and with carpus two-thirds as long again as merus *pulleini* Hale
- Second peracopod reaching only to about middle of length of basis of first leg, and with carpus subequal in length to merus *vicaria* sp. nov.
- 3 Dorsal margins of pedigerous somites, as seen from the side, undulating. One of the terminal spines of endopod of uropod geniculate (female) or hooked (male). Pleon with obvious lateral and dorsal carinae *obstipa* sp. nov.
- Dorsal margins of pedigerous somites smooth. Terminal spines of endopod of uropod straight (barely curved). Pleon smooth, or with scarcely distinguishable traces of carinae 4
- 4 Size under 5 mm. Second joint of endopod of uropod much more than half length of first *serrifera* sp. nov.
- Size about 7 mm. Second joint of endopod of uropod about half as long as first, or less 5
- 5 First peracopod with propodus much longer than dactylus. Second peracopod with propodus and dactylus subequal in length *sheardi* Hale
- First peracopod with propodus scarcely longer than dactylus. Second peracopod with dactylus fully one-third as long again as propodus *intermedia* sp. nov.

LEPTOCUMA PULLEINI Hale

Leptocuma pulleini Hale 1928, 38, fig. 7-8; and 1936, 409.

Adult Male. Carapace about one-fifth of total length of animal, its depth equal to its width and one-half of its length; seen from above it has the form (as in the ovigerous female previously described) of a cylinder truncated at each end;

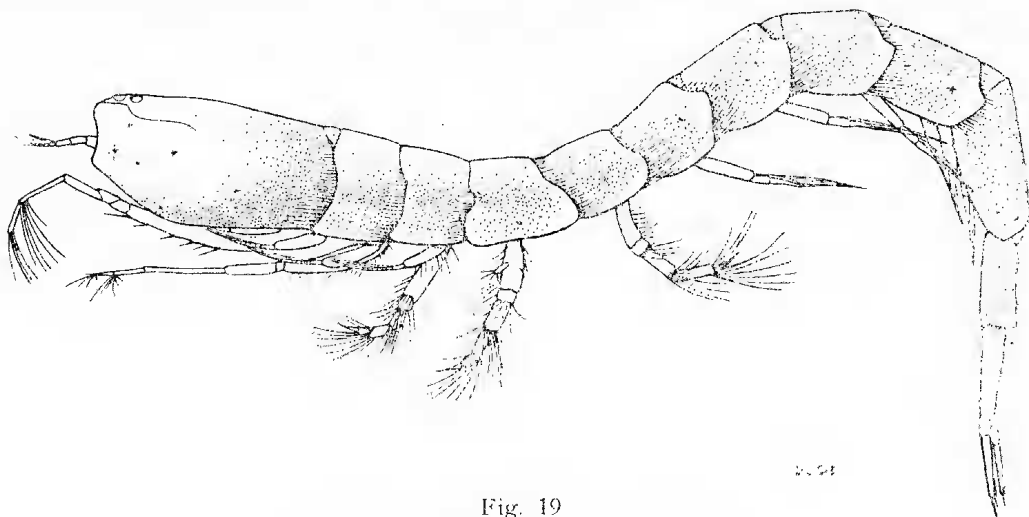


Fig. 19
Leptocuma pulleini, adult male (x11).

dorsal carina as in female, low and fading posteriorly. Ocular lobe larger than in female, slightly wider than long and with a tiny incision at apex; there are three prominent lenses arranged in a triangle, the centre one pigmented and having

the appearance of including a pair of oval lenses; on each side there are three much smaller lenses. Pseudorostral lobes rather widely truncate in front; as usual in the genus, extending in advance of ocular lobe but with inner (medial) margins bent down and not meeting in front of eye-lobe. Antennal notch so widely open as to be obliterated; angle rounded.

Pedigerous somites two to five with a faint median dorsal carina; again as usual in the genus, the anterior margins of the second, third and fourth somites are fringed with short bristles, and there is a similar row on the posterior edges of the fourth and fifth.

Pleon somites with faint dorsal carina and with indications of lateral carinae on second to fourth; first four somites with a fringe of rather long setae posteriorly.

Flagellum of first antenna four-jointed and with two tiny terminal jointlets, apparently bases of the sensory appendages.

Mandible with about 18 spines.

First peraeopod with carpus reaching well beyond antennal angle; basis with long plumose seta at external distal angle and with inner distal spine longer than ischium; on the distal half of inner margin, posterior to the apical spine is a row of shorter spines of two different lengths; propodus more than one and three-fourths times as long as dactylus and a little longer than the carpus.

Second peraeopod reaching forward beyond end of basis of first; basis only about three-fifths as long as terminal joints together; carpus two-thirds as long

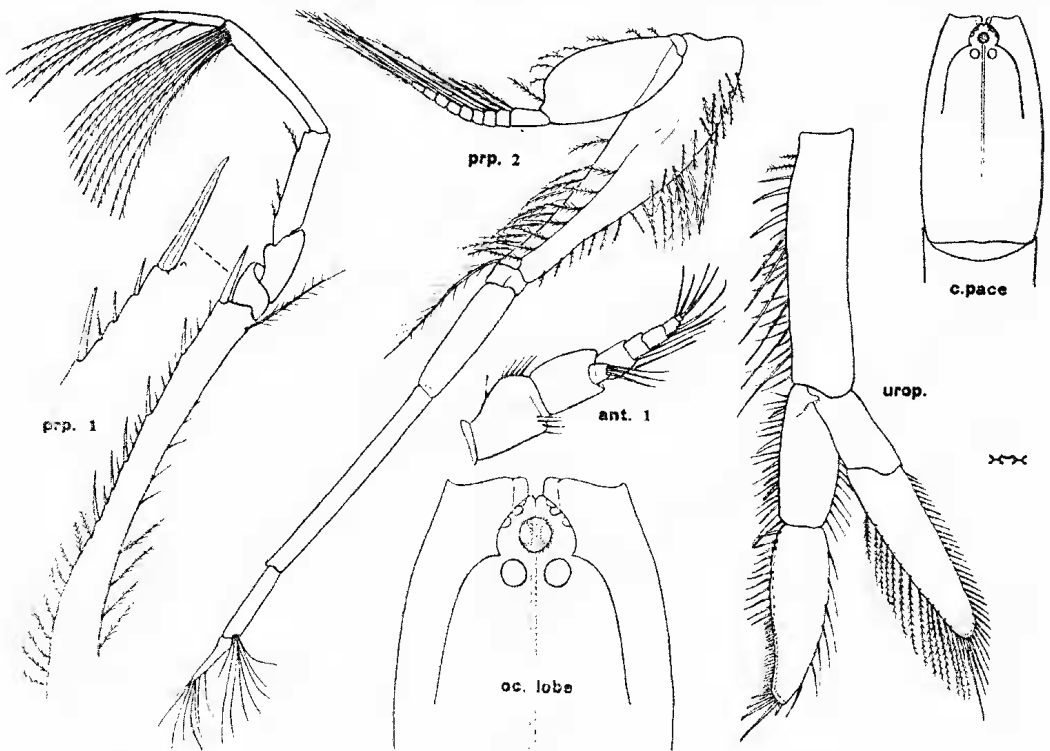


Fig. 20

Leptocuma pulleini, adult male; c. pace, carapace from above (x 11); oc. lobe, anterior portion of carapace (x 29); ant. 1, distal peduncular joints and flagella of first antenna (x 72); prp. and urop., peraeopods and ventral view of uropod (x 36; spines, x 72).

again as merus and more than two and one-half times as long as propodus, which is longer than the dactylus.

Third to fifth peraeopods with a large number of flexible setae on ischium, merus and carpus (ten or more) and the usual one on propodus; basis with plumose setae. The rudimentary exopod of the fourth has the vestigial second joint as in the female.

Uropod with peduncle shorter than either telsonic somite or rami, with a few stout spines and two series of stout setae on inner margin; endopod distinctly longer than exopod; as in the female the second segment is one-fourth as long again as first, but the armature is not the same, there being on the distal half of the second joint a comb of spines which are shorter and of different type from those on the proximal part.

Colour, white, with sparse stellate spots (night).

Length, 13.5 mm.

Loc.—New South Wales: Cronulla, 8 feet, on coarse sand (H. M. Hale and K. Sheard, submarine light, Sept. 1942 and Jan. 1944).

Ovigerous Female. Described in detail previously. There are several spines on the inner margin of the basis of the first peraeopod. Examination when not immersed in alcohol and partly dry reveals the presence of very low, smooth but distinct dorso-lateral, lateral and infero-lateral carinae on the pleon, the last-named ridges most apparent on the first four somites.

Hab.—South Australia and New South Wales.

The first recorded specimens of this species were collected in June 1886 by the late Dr. Robt. Pulleine, and, despite searching, it has not been taken since in South Australia. Two adult males were secured in New South Wales; one is a little smaller than that described and figured, but otherwise agrees in detail. The discrepancy in size between examples from the two localities is considerable, the immature male recorded from South Australia being 19 mm. in length and the ovigerous female still larger (24 mm.), but I can find no other character to separate them.

***Leptocuma vicaria* sp. nov.**

Ovigerous Female. Carapace about four and one-half times in total length and not quite as long as first four pedigerous somites together; its depth is equal to width and more than half its length; viewed from either above or from the side the carapace tapers markedly to the front; there is a median dorsal carina very distinct on anterior three-fourths of length and (unlike that of *pulleini*) slightly serrate in appearance. Ocular lobe small; lenses present but not well defined, although nine or ten separate small areas are indistinctly discernible; there is a small incision in the apex of the lobe. Pseudorostral lobes narrow anteriorly with inner margins, in front of eye-lobe, bent strongly downwards. Antennal notch distinct (not so widely open as in female of *pulleini*) and angle subacute.

Second to fifth pedigerous somites with dorsal median carina and with the one or two shallow longitudinal furrows (usually present in all species) on sides.

First five pleon somites with median dorsal carina, slightly tuberculate dorso-lateral, lateral and infero-lateral carinae; telsonic somite with dorso-lateral and lateral carinae.

First antenna with flagellum three-jointed; first joint of peduncle much longer than second, which is nearly twice as long as third; accessory flagellum short.

Second antenna, see fig. 18, B.

Third maxilliped as in *pulleini*.

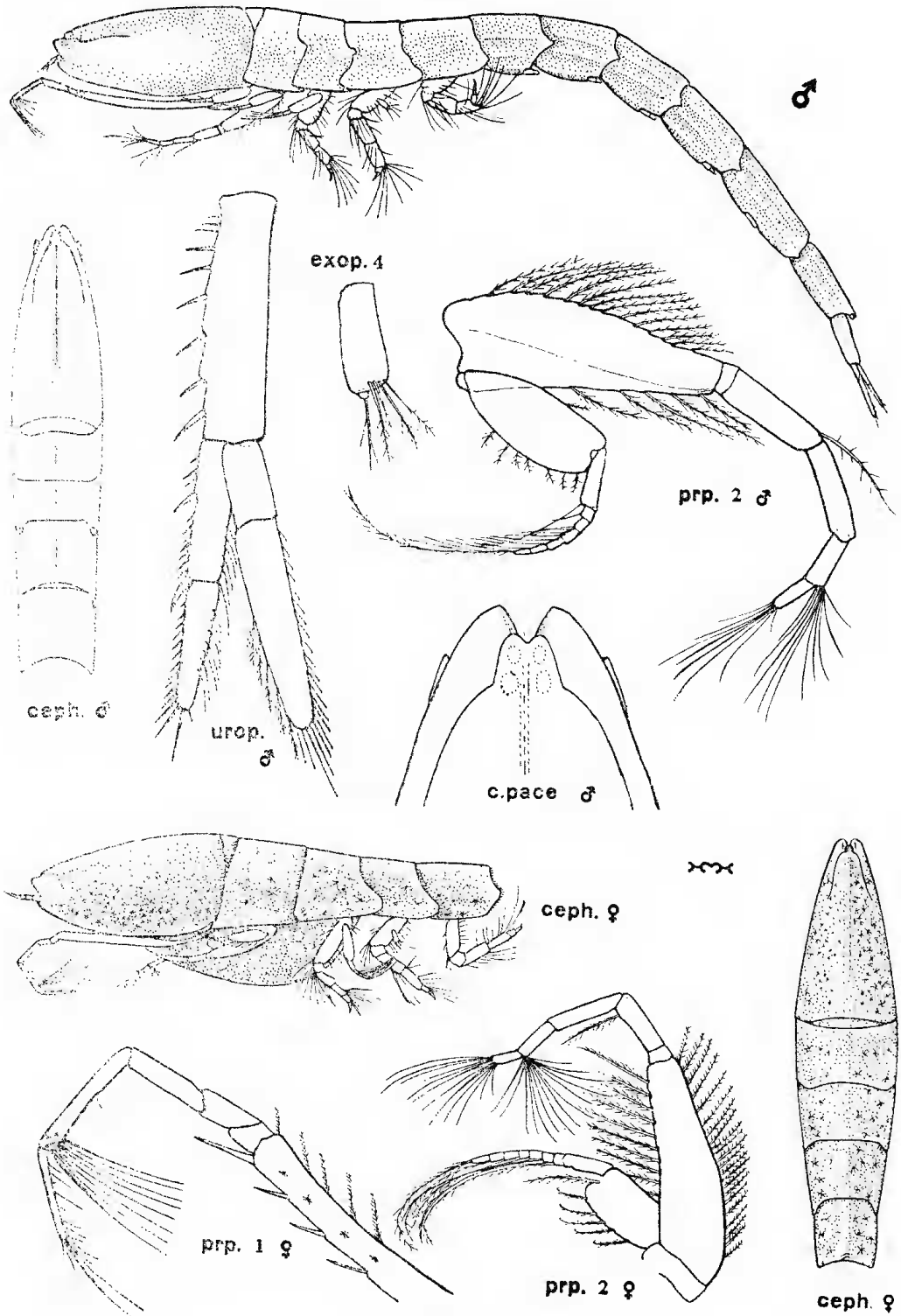


Fig. 21

Leptocuma vicaria. Type ovigerous female; ceph., cephalothorax from side and above ($\times 7\frac{1}{2}$); prp., pereopods ($\times 25$). Allotype male; from the side and (ceph.) cephalothorax from above ($\times 8$); c. pace, anterior portion of carapace ($\times 40$); prp. 2 and urop., second pereopod and uropod ($\times 40$); exop. 4, exopod of fourth pereopod ($\times 50$).

First peraeopods with basis not nearly reaching to level of antennal angle, nearly half as long again as rest of limb, and with three shorter spines preceding the distal inner spine, which is longer than the ischium; plumose setae on both margins; propodus less than one-half as long again as dactylus and much longer than carpus.

Second peraeopod reaching only to middle of length of basis of first; basis barely longer than rest of limb; carpus subequal in length to merus and distinctly less than twice as long as propodus, which is longer than the dactylus.

Third to fifth peraeopods much as in *pulleini*.

Peduncle of uropod shorter than telsonic somite or rami, its inner margin with six strong spines and, near proximal end, three slender spines; endopod shorter than exopod, the second segment barely longer than the first, which has ten spines on inner margin, the third and particularly the distal being larger than the others; second joint with a score of inner spines successively increasing in length and longest terminal spine fully half the length of the joint; inner margin of endopod with a row of setae not differing markedly in length; second segment of exopod more than two and one-half times as long as first (thus relatively longer than in *pulleini*) and with a gradated series of composite setae on outer margin, the longest terminal ones one-fourth or more the length of joint.

Colour pale brown, densely spotted with dark stellate markings.

Length, 17.5 mm.

Subadult Male. General form even more slender than in female. Carapace with sharply defined carina, and tapering as described but more than twice as long as width or depth. Ocular lobe larger, a little wider than long, with apex more markedly bilobed than in female, but with lenses not distinct. Antennal notch and angle as in female, but doubtless the notch opens in the adult; the antennal angle is visible when the animal is viewed from above.

Similar ridges are present on the pedigerous and pleon somites.

The first antennae have the flagellum only two-jointed at this stage.

The peraeopods have fewer setae (due to immaturity). The basis of the second peraeopod is slightly shorter than the rest of the limb. The rudimentary exopod of the fourth pair has the second vestigial joint found in the female and in both sexes of *pulleini*.

The uropods resemble those of the female; but it is probable that the spines become more specialised in the adult male; the first joint of the endopod is very slightly longer than the second.

Length, 15.5 mm.

Loc.—New South Wales: 24 miles east of Pt. Hacking, surface (allotype male, K. Sheard, Oct. 1940); off Wata Mooli, 35 metres on sand (type female, "Cronulla" Trawl Station 2, March 1943); off Jibbon, 40 metres ("Cronulla" Trawl Station 6, July 1943) and 45-50 metres, on coarse sand ("Cronulla" Trawl Station 10, Aug. 1943). Types in South Australian Museum, Reg. No. C.2451 and C.2501.

At the point where the allotype male and other specimens were taken at the surface the water is 600 metres in depth.

Although obviously allied to *pulleini*, *vicaria* can be readily separated at all stages by the entirely different proportions of the second peraeopod and the more prominent dorsal carina of the carapace. In young individuals (10 mm. or less) the carapace is shaped as in the adult of *pulleini*, *viz.*, it is not markedly narrowed towards the front as in adult examples or those more nearly approaching maturity.

In very small specimens the setae of the peracopods are much less numerous and the characteristic brushes on the propodus and dactylus of the first legs are represented by only three or four setae.

Amongst other smaller points of difference, the eye-lenses are not so distinct as in *pulleini*, the endopod of the uropod is shorter than the exopod instead of longer than it, and its segments are subequal in length; the second joint of the exopod of the uropod is relatively longer and the terminal joints of the first peracopods are of different proportions.

***Leptocuma obstipa* sp. nov.**

Ovigerous Female. Carapace robust, less than one-fourth of total length of animal; depth equal to width and not quite three-fourths of its length; dorsal carina distinct; there is a long shallow depression on each side of the carina for about three-fourths of its length and this accentuates the ridge; posterior to these hollows the carina bifurcates; on posterior half of carapace is a pair of short ridges

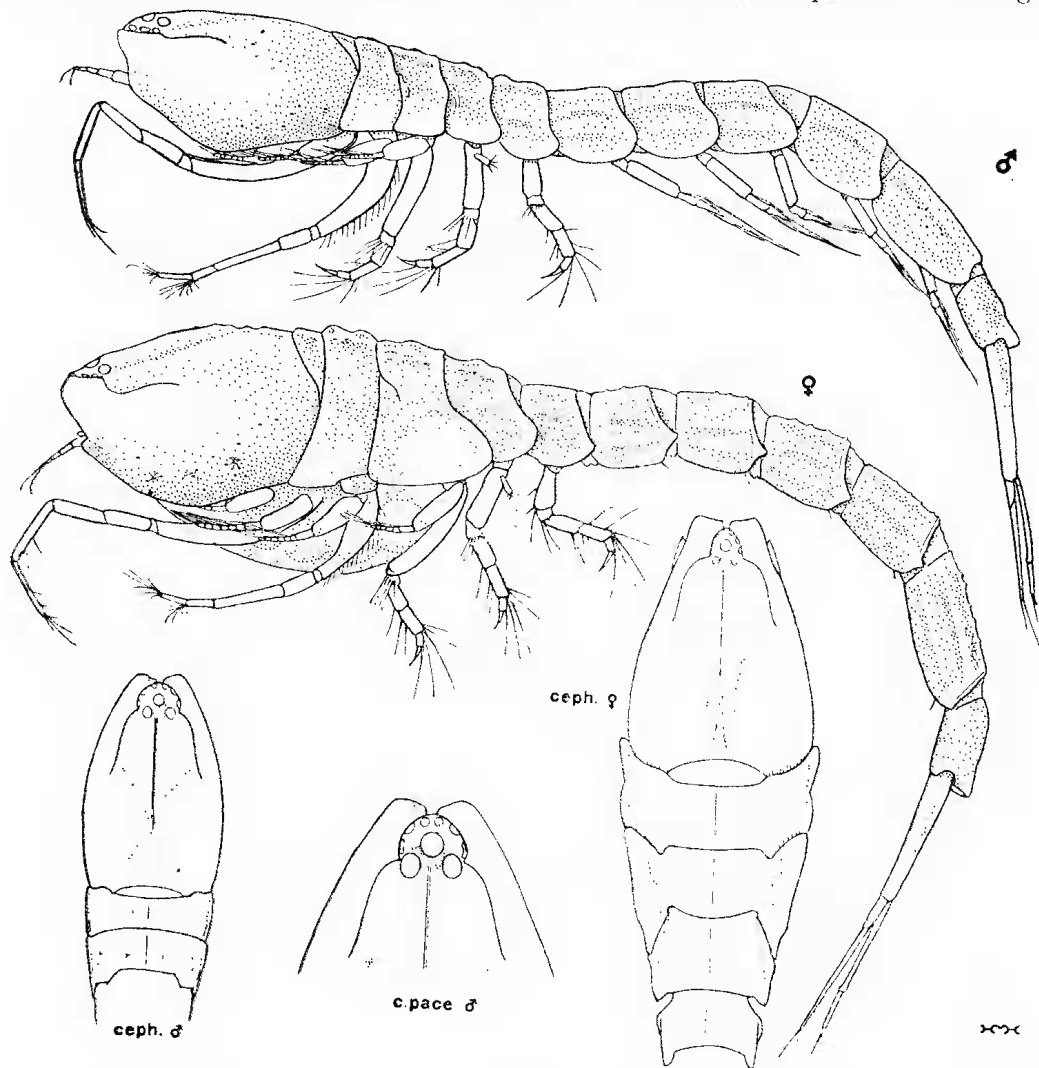


Fig. 22

Leptocuma obstipa, type female and allotype male: lateral views and (ceph.) cephalothorax (x 19); c. pace, anterior portion of carapace (x 30).

which, as seen from the side, are undulating. Ocular lobe pigmented, as wide as long and with nine colourless lenses, the median one larger than the others. Antennal notch moderately wide, a little obtuse, and angle rounded.

The five pedigerous somites together are longer than the carapace and half as long as the pleon; lateral parts of third somite overlapping second in front and fourth behind; each has a median dorsal ridge and a low undulating dorso-lateral carina; on the fourth and fifth somites there is also a low lateral tumidity.

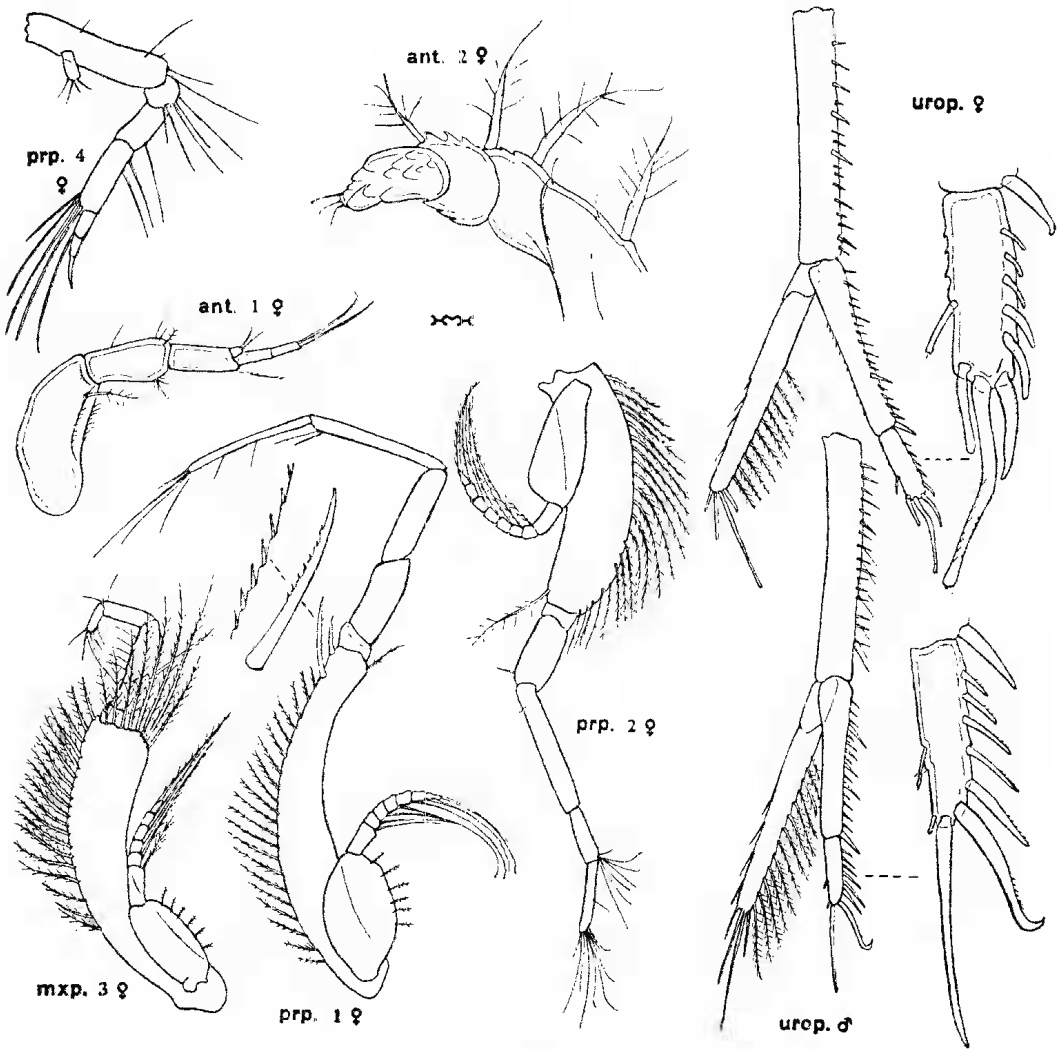


Fig. 23

Leptocuma obstipa, paratype ovigerous female and allotype male; ant. 1, first antenna (x83); ant. 2, second antenna (x175); mxp. 3, prp. and urop., third maxilliped, peraeopods and uropods (x42).

First five somites of pleon with median dorsal carina and a sparsely tuberculate dorso-lateral carina on each side; there are also two tuberculate lateral ridges; the lower not well marked.

First joint of peduncle of first antenna as long as second and third segments together; second longer than third which is as long as the two-jointed flagellum.

Third maxilliped with basis generously furnished with stout plumose setae, there being eight or so at the subtruncate distal end.

First peraeopod with carpus reaching level of antennal angle; basis five-sevenths as long as terminal joints together; inner margin with plumose setae; dactylus slender, almost as long as propodus, which is one-third as long again as carpus.

Second peraeopod not reaching distal end of merus of first; basis as long as rest of limb without dactylus, its inner margin with long plumose setae; propodus three-fourths as long as dactylus and distinctly less than half as long as carpus.

Third to fifth peraeopods with four distal carpal setae, two longer than the others and reaching, with propodal seta, well beyond tip of dactylus.

Peduncle of uropod much longer than telsonic somite and equal in length to each ramus; inner edge with a row of sixteen unequal spines; exopod with plumose setae on inner margin, a few adpressed spines on outer edge and four unequal terminal spines, the longest half as long as second joint of ramus; first joint of endopod with spines much as in *serrifera*, but nearly two and a half times longer than second joint; second joint with five curved spines successively increasing in length on inner margin and three, unequal, on the rounded distal end; the middle and longest of these terminal spines is as long as the segment, is of plicate appearance, rounded apically and is geniculate.

Colour white with sparse brown chromatophores, which form a conspicuous marking on the second and third pedigerous somites.

Length, 7.5 mm.; ova, 0.3 to 0.4 mm.

Adult Male. Body proportions much as in female but build considerably more slender. The carinae of pedigerous somites and pleon are much more feeble but are still faintly tuberculate; seen from the side the thoracic somites have the undulating appearance characteristic of the species.

Carapace narrow, with the sides as seen from above evenly rounded; its depth is equal to the width and not a great deal more than half its length. Ocular lobe larger than in female and wider than long; the three median lenses are large and conspicuous. Antennal notch very widely open and "angle" obtusely rounded.

Pedigerous somites differing from female as usual in the group.

Peduncle of uropod as long as exopod but a little longer than endopod; the second joint of the last-named has five serrate spines on inner margin and two distal spines; the longer of these is curved and is longer than the joint, the other is hooked and serrate; other armature of uropods much as in female but longer.

Length, 6.8 mm.

Loc.—New South Wales: off Jibbon, 35 fath., in coarse sand (K. Sheard, Feb. 1940); off Wata Mooli, 70 metres ("Cronulla" Trawl Station 4, July 1943); off Jibbon, 45-50 metres, coarse sand (*type loc.*, "Cronulla" Trawl Station 10, Aug. 1943). Types in the South Australian Museum, Reg. No. C.2488, C.2489.

Only one male is available. A series of ovigerous females from the three localities all have the bent terminal spine on the endopod of the uropod, as figured. This and the slight irregularity of the dorsal outline enable one to separate the species with ease.

Some smaller ovigerous females (length, 7 mm.; ova, 0.4 mm.) have the above characters but the propodus and dactylus of the first peraeopods are relatively shorter; the propodus is as usual scarcely longer than dactylus, but it is also barely longer than the carpus.

Leptocuma serrifera sp. nov.

Ovigerous Female. Integument thin, very finely reticulate, smooth and polished.

Carapace short and robust with dorsal edge scarcely arched, appearing slightly uneven owing to insignificant sinuations; less than one-fourth of total length of animal; its depth is equal to its greatest width and is more than three-fourths its length; seen from above the curved sides diverge from the moderately wide front; the median dorsal carina is obsolete. Ocular lobe wider than long, pigmented and with distinct lenses. Antennal notch shallow and angle obtusely rounded; a shallow oblique furrow to rear of notch.

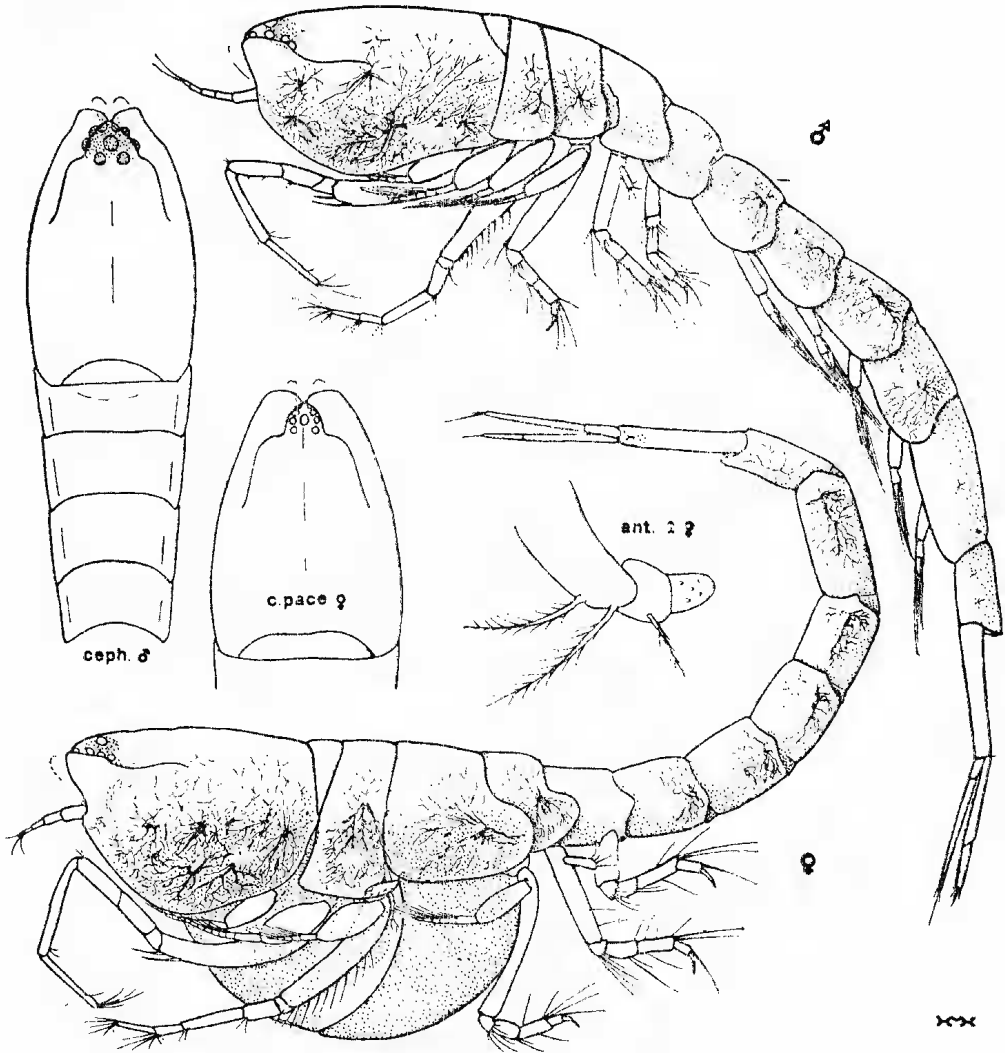


Fig. 24

Leptocuma serrifera, type ovigerous female and allotype male; lateral views. (ceph.) cephalothorax and (c. pace) carapace ($\times 30$); ant. 2, second antenna of female ($\times 160$).

The five pedigerous somites are without carinae, together they are fully half as long as the pleon and much longer than the carapace; third and fourth somites with rounded postero-lateral lobe, and hinder margin of fifth a little backwardly produced on sides.

Pleon slightly tapering, the somites subcylindrical and, excepting fifth, subequal in length; without dorsal or other ridges.

First antenna slender; first joint of peduncle shorter than second and third together; second barely longer than third and as long as the two-jointed flagellum; accessory lash single-jointed.

Mandible with about 12 spines in the row.

Basis of third maxilliped more than half as long again as remaining joints together; margin immediately exterior to palp sloping backwards and with long plumose setae; inner margin with long setae on proximal half and shorter plumose setae on distal half.

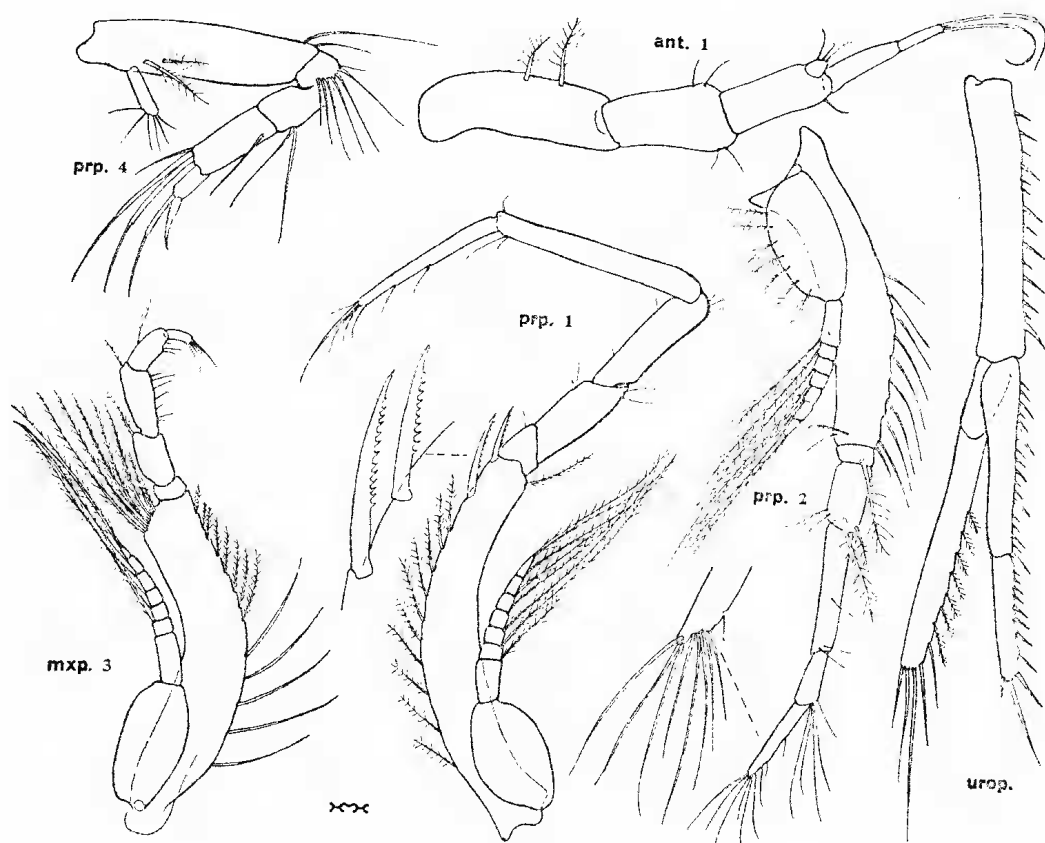


Fig. 25

Leptocuma serrifera, paratype ovigerous female; ant. 1, first antenna (x 155); mxp. 3, prp. and urop., third maxilliped, peraeopods and uropod (x 74; spines of basis of first leg and tip of dactylus of second, x 155).

First peraeopod with carpus reaching to level of antennal angle; basis only about four-sevenths as long as the long terminal joints together, and with a plumose seta at external angle; inner (inferior) margin with a row of plumose setae; dactylus long, but only three-fourths as long as the propodus, which is more than half as long again as carpus; merus not much shorter than carpus.

Second peraeopod reaching to distal end of merus of first; basis almost as long as rest of limb, its inner margin with long flexible setae similar to the fossorial setae of the posterior peraeopods; carpus much longer than ischium and merus together; propodus fully two-thirds as long as dactylus and almost half as long as carpus.

Third to fifth peraeopods with two distal carpal setae of equal length and a third much shorter; together with the propodal seta the longest reach very much beyond the tip of the dactylus.

Peduncle of uropod slender, considerably longer than telsonic somite, but shorter than the equal rami; inner margin with a row of 15 unequal spines, half-a-dozen of which are prominently longer than the others; exopod with short plumose setae on inner margin and with several terminal setae, one conspicuously the longest and more than half as long as the ramus; first joint of endopod little more than half as long again as second and with eighteen inner unequal spines; second joint with about eight finely serrate spines, successively and regularly increasing in length, on inner edge, and with three unequal finely serrate distal spines, the longest barely more than half the length of the longest apical seta of exopod.

Colour pale yellow, with conspicuous sprawling chromatophores.

Length, 4.4 mm. (ova, 0.15 mm. in diameter).

Adult Male. Carapace with dorsal outline not exhibiting the slight irregularity apparent in the female; one-fourth of total length of animal, its depth equal to width but rather less than two-thirds its length; seen from above the curve of the sides is more pronounced, the greatest width being at the middle of the length. Antennal notch more widely open (represented merely by a shallow concavity) and antennal angle very obtusely rounded, almost imperceptibly angular. Ocular lobe and lenses about one-third as large again as in female.

The five pedigerous somites together are not quite half as long as the pleon and are equal in length to the carapace; the third locks into a rebate in fourth and is not considerably expanded posteriorly.

Last pedigerous and first four pleon somites produced postero-laterally on each side to form a rounded lobe.

First peraeopod a little longer than in female, and with joints of same proportions.

Uropod slightly longer; peduncle and rami of same proportions but spines and setae longer.

Length, 4.2 mm.

Loc.—New South Wales: Cronulla, 8 feet, on coarse sand (K. Sheard, submarine light, Sept. 1942). Types in South Australian Museum, Reg. No. C.2484-C.2485.

Differs from *sheardi* in (1) the smaller size; (2) the relatively longer propodus of the first peraeopod; (3) the relatively longer dactylus of the second peraeopod; (4) the different proportion of the endopod of the uropod; (5) the fewer carpal setae on the fossorial legs.

LEPTOCUMA SHEARDI Hale

Leptocuma sheardi Hale, 1936, 409, fig. 3-4; and 1937, 65.

Only the longer of the two distal serrate spines of the basis of the first leg was noticed in the original description; the shorter one may be concealed behind the ischium. The female was described previously in some detail.

Adult Male. Carapace with depth less than two-thirds of its length; the median dorsal carina appears as three fine parallel lines extending from the large median eye-lens to level of posterior ends of pseudorostral sutures; beyond this it bifurcates and quickly fades out. Ocular lobe pigmented, large, wider than

long and with nine lenses; three are larger than the others and arranged in a triangle, the others three on each side of the lobe. Antennal notch very widely open (more so than in female) and angle rounded and obtuse.

Pedigerous somites without ridges; third somite not backwardly produced postero-laterally to form a rounded lobe as in female.

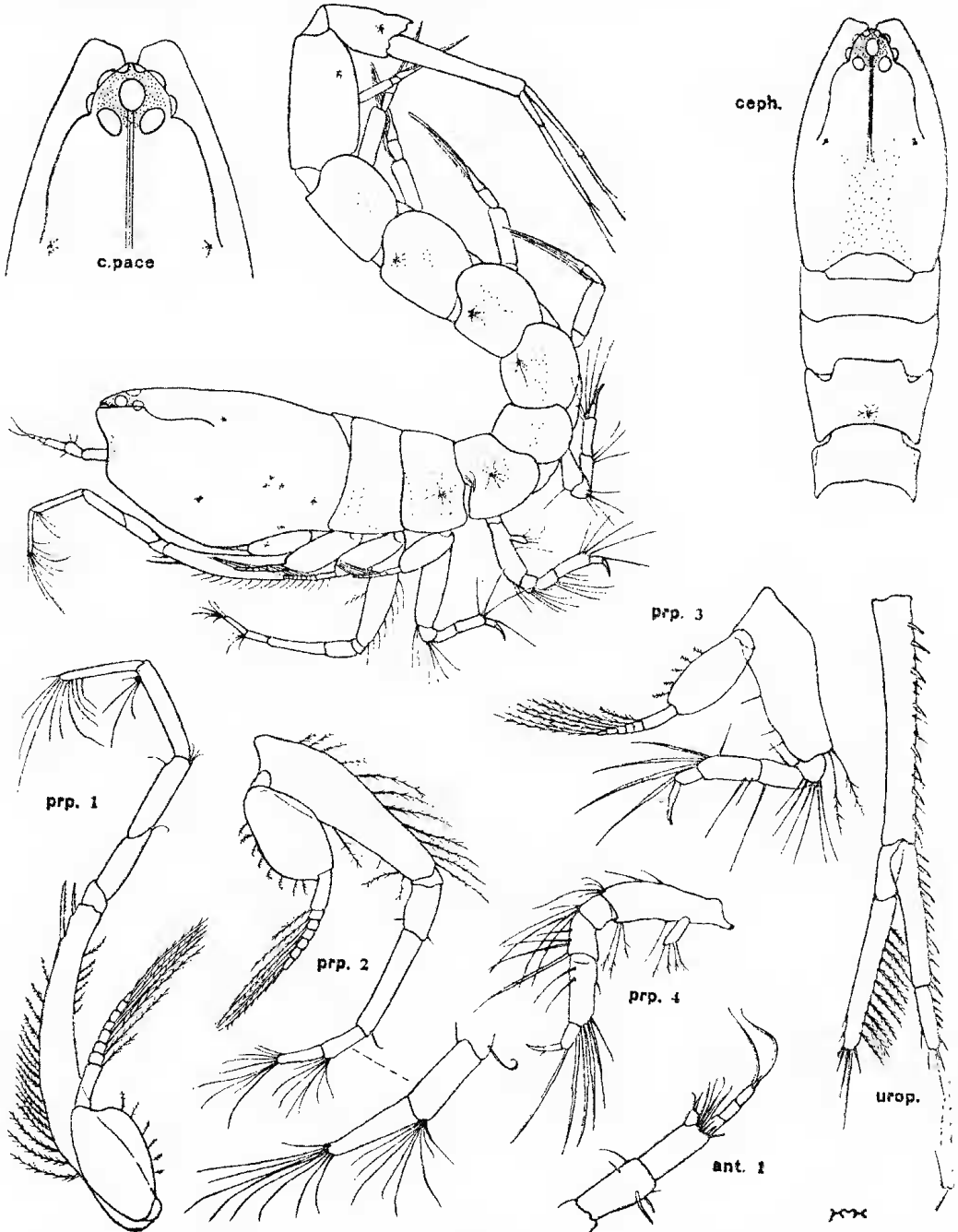


Fig. 26

Leptocuma sheardi adult male; lateral view and (ceph.) cephalothorax from above (x 19); c. pace, anterior half of carapace (x 30); ant. 1, distal peduncular joints and flagella of first antenna (x 78); prp. and urop., peraeopods and uropod (x 39; terminal joints, etc., x 78).

First to fourth pleon somites with postero-lateral portions rounded; median and dorso-lateral carinae can be discerned on the fourth and fifth somites but are very faint.

First antenna with the main flagellum three-jointed (two in female) and with a brush of sensory filaments at its base.

Mandible with about 12 spines.

First peraeopods slightly longer than in female; basis not much shorter than rest of limb; dactylus three-fourths as long as propodus, which is not much longer than carpus; ischium and merus together as long as carpus; the dactylar setae number 10 or so.

Second peraeopods not reaching to distal end of merus of first; basis as long as rest of limb without dactylus, with a row of inner plumose setae; dactylus barely longer than propodus and distinctly less than half as long as carpus.

Third to fifth peraeopods with a fan of long subdistal carpal setae, four on the third pair and five on the fourth and fifth. Fourth with rudimentary exopod single-jointed.

Peduncle of uropod a little longer than the equal rami, with about 15 or 16 spines, half of which are conspicuously stouter than the others; first joint of endopod a little more than twice as long as second (not quite twice as long as second in female); armature of rami as in female but plumose spines of exopod more numerous.

In specimens taken at night the colour markings (see previous notes) may be contracted to single stellate spots, as shown in the figure.

Length, 7 mm.

Hab.—The species has been taken only in South Australia, occurring in the southern parts of St. Vincent and Spencer Gulfs and also in Antechamber Bay, Kangaroo Island; it has been netted at the surface at night and to a depth of 7 fathoms.

***Leptocuma intermedia* sp. nov.**

Adult Male. Very like the male of *L. sheardi* but with the following differences.

First peraeopod with dactylus almost as long as propodus. Second peraeopod with dactylus fully one-third as long again as propodus and distinctly

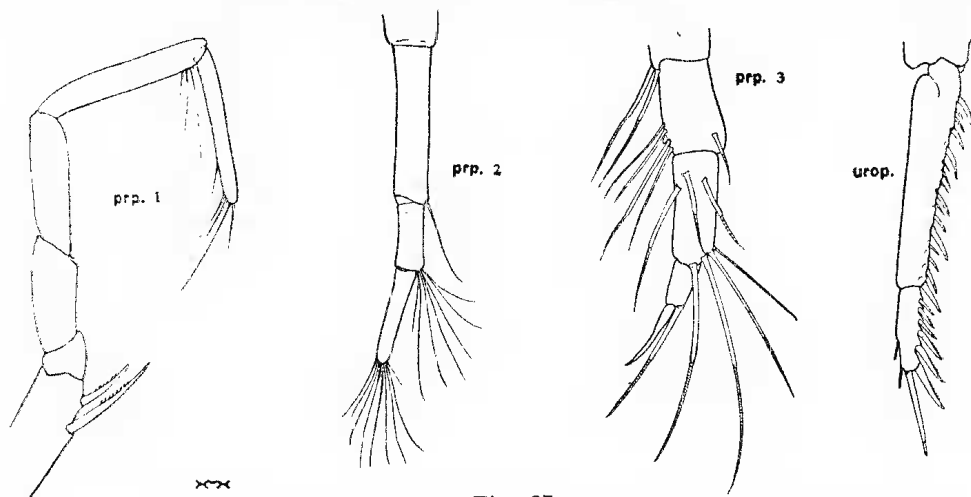


Fig. 27

Leptocuma intermedia, type male; prp. and urop., terminal joints of peraeopods and endopod of uropod (x 66).

more than half length of carpus. First joint of endopod of uropod more than two-and-one-half times longer than second.

Length, 6.6 mm.

Loc.—New South Wales: Cronulla, 8 feet, on coarse sand (K. Sheard, submarine light, Sept. 1942). Type in South Australian Museum, Reg. No. C2496.

This form was taken with *serrifera* at Cronulla, a locality rich in species of Cumacea; apart from the larger size it differs in the very different proportions of the carpus, propodus and dactylus of the first pereopods, and in the much shorter distal segment of the endopod of the uropod as well as other small details.

Genus VAUNTHOMPSONIA Bate

A single imperfect specimen is described below because it represents the only record of the genus in the Australian region. It is closer to the genotype than is *meridionalis* Sars, the only species which has the external distal part of the third maxilliped at all produced. Also, in the last-named species there are only nine spines on the short distal portion of the mandible, the branchial lobes are digitiform and reduced to four, and the telsonic somite is only slightly produced posteriorly; as is apparently usual in the genus, the third maxilliped has the ischium short, and the carpus as long as it and merus together, while the accessory flagellum of the first antenna is single-jointed.

Zimmer (1908, 165; and 1921, 131) is of the opinion (not shared by the present writer) that *Bathycuma* should be regarded as a subgenus of *Vaunthompsonia*.

The adult of both sexes is known only in the genotype, *cristata* Bate; in this species the dorsal median carina of the female is finely dentate, that of the male unarmed.

Vaunthompsonia nana sp. nov.

Adult Male. Integument thin, smooth and polished.

Carapace with dorsal margin curving upwards from tip of pseudorostrum to above ocular lobe, thence to hinder end almost straight; one-fourth of total length of animal, slightly compressed and with depth equal to about two-thirds of length; dorsum rounded, very obscurely angular along the mid-line but without longitudinal ridge; inferior margin finely toothed on anterior half; seen from above the front third of the carapace is subtriangular in shape, thence the sides are almost parallel. Infero-lateral margins evenly concave, there being no true antennal notch; antennal "angle" rounded. Pseudorostral lobes extending in front of ocular lobe which is as wide as long, with nine lenses, four lateral pale ones, and five large and black.

First pedigerous somite partly exposed; second over-lapping third and carapace at postero-lateral and antero-lateral corners inferiorly.

Pedigerous and pleon somites of equal width (excepting first pedigerous) without ridges but with faint suggestion of angular rounding at mid-line and dorso-lateral areas.

Pleon not much longer than cephalothorax; first four somites of equal size and with inferior and postero-lateral margins finely crenulate; telsonic portion of last somite subtriangular in side view and also as seen from above, and with a pair of terminal setules.

Peduncle of first antenna with first joint as long as second and third together; second not longer but considerably thicker than third, which is as long as the three-jointed flagellum; accessory lash as usual single-jointed.

Mandible with thirteen spines in the row.

Third maxilliped with basis not at all produced at apex, with plumose hairs on inner margin and with a series of stout plumose setae at external apical angle; merus slightly dilated distally and with an external apical spine; carpus equal in length to propodus, and also to ischium and merus together; dactylus short, with a stout apical spine and short setae.

Basis of first peraeopods short, with a few plumose setae on inner margin and a short plumose seta and a long spine near external apical angle; exopod wider than basis; rest of limb missing.

Second peraeopod damaged.

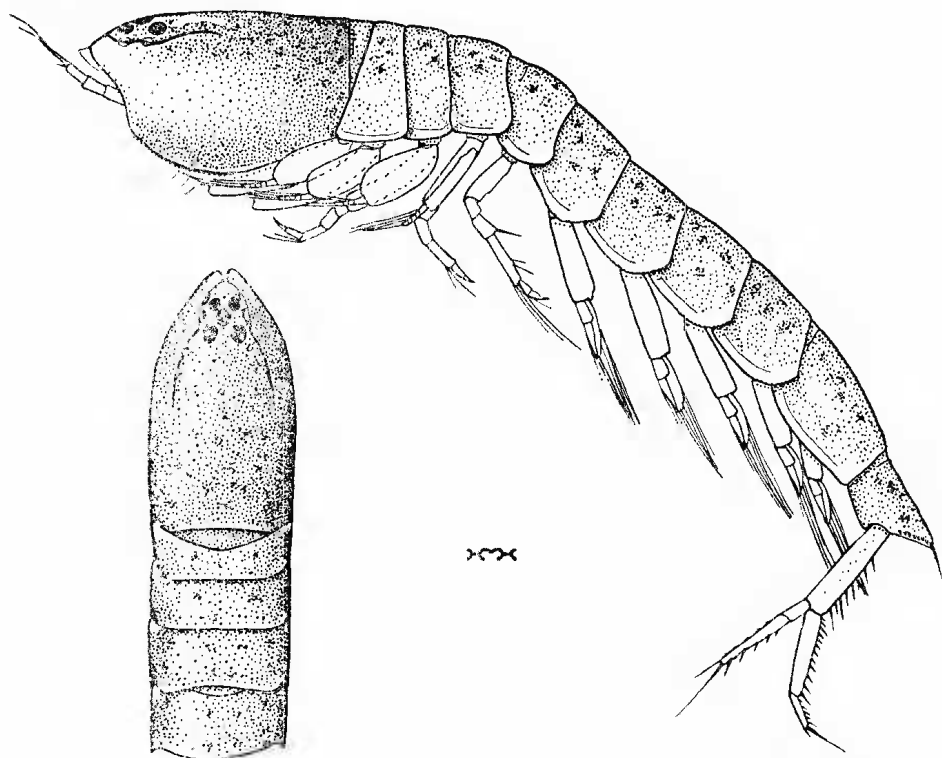


Fig. 28

Vaunthompsonia nana; lateral view and cephalothorax of type male (x65).

Carpus of fossorial legs at least as long as ischium and merus together, successively increasing in length, so that in the fifth pair it is as long as the basis; two distal carpal setae, the longer reaching beyond level of tip of dactylus; third with basis longer than rest of limb and narrower than the base of the large exopod; fourth and fifth with basis shorter than remaining joints together. Peduncle of exopod of fourth more than half as wide as basis.

Peduncle of uropod as long as telsonic somite, and as exopod, with a series of eight unequal spines; exopod four-fifths as long as endopod, with first joint half length of second which has five short spines on outer margin, five longer ones on inner edge and two apical spines, the longer equal to the segment in length; first joint of endopod more than twice as long as second, with a dozen spines on inner margin; second joint of endopod with four inner and three apical spines, the longest longer than the joint (fig. 29 for relative lengths of armature).

Colour yellowish, generously marked with black pigment, particularly on the dorsum.

Length, 1.9 mm.

Loc.—South Australia: Rapid Bay (H. Cooper and E. Hanka, submarine light, Jan. 1944). Type in South Australian Museum, Reg. No. C.2444.

This is the smallest species to be referred to *Vaunthompsonia*. Its smooth streamlining and well-developed natatory appendages suggest that the male is a particularly efficient swimmer.

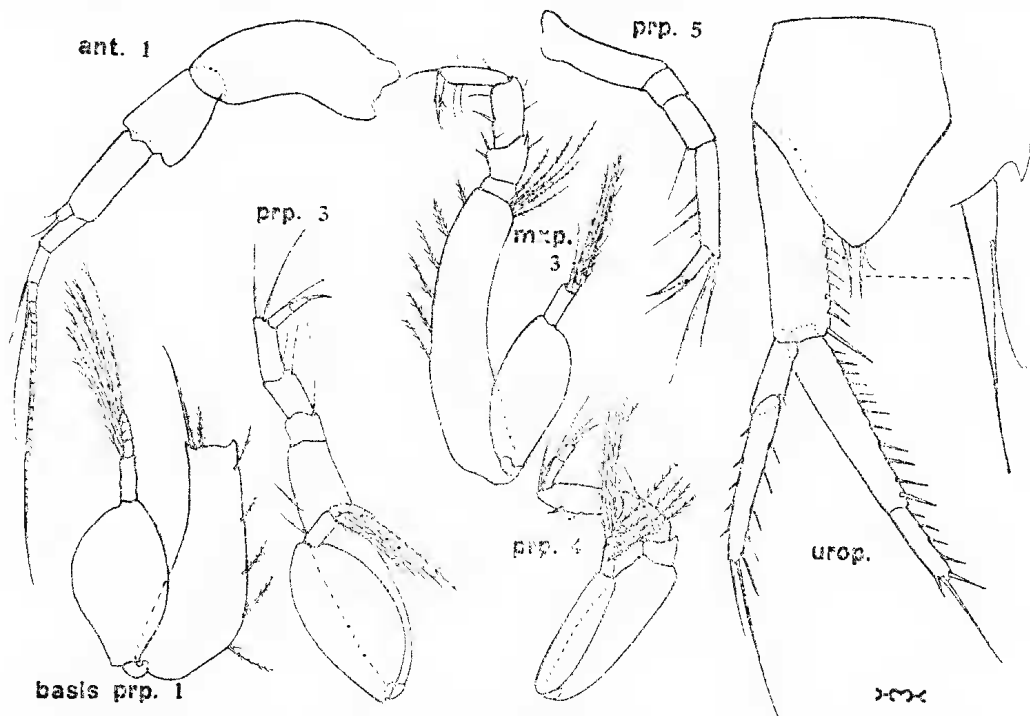


Fig. 29

Vaunthompsonia nana, type male: ant. 1, first antenna (x210); prp. and urop., pereopods, and uropod with telsonic somite (x100).

It seems to be close to *arabica* Calman (1902, 29, pl. vii, fig. 20-24—Suez and Aden), but the carapace is of different shape, the basis of the first pereopods is still shorter and stouter; also the proportions of the joints of the last pair of pereopods seem to be distinctive. The first and second legs may show other differences.

Gen. *Glyphocuma* nov.

Pseudorostral lobes not extending in front of ocular lobe, which is narrow or moderately wide.

Basis of third maxilliped with large external distal lobe, dentate on inner edge and reaching to or beyond front end of merus, which is not or scarcely expanded.

Male with exopods (having peduncle and jointed flagellum) on first to fourth pereopods, those of the fourth pair sometimes small. Female with exopods on first three pairs only.

First antenna with accessory flagellum two-jointed. Second antenna of female three-jointed, with the conical distal joint distinctly separated off.

Mandibles elongate, with a long row of spines approaching a score in number.

Telsonic somite well produced posteriorly, its apex rounded and very slightly excavate.

Genotype *Sympodomma bakeri* Hale.

The female second antennae of two species and of ?*Sympodomma africana* are shown in fig. 30. They are apparently very much as in *Bathycuma elongata* Hansen, excepting that the conical terminal joint is articulated. The large first and second joints are not very distinctly separated, and the distal part of the second is divided off by a faint suture.

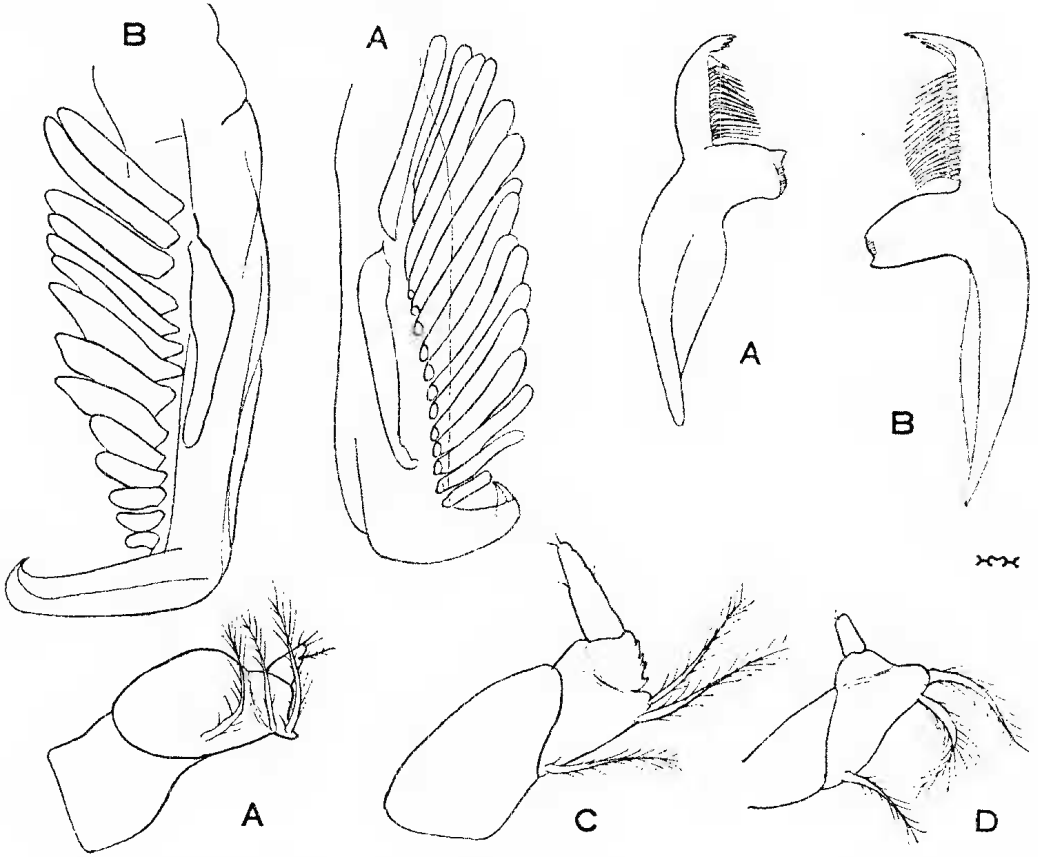


Fig. 30

Glyphocuma, branchial lamellae, mandibles and female second antennae; A, *bakeri*; B, *inaequalis*; C, *dentata*. D, Second antenna of female of ?*Sympodomma africana*.

The branchial lamellae are delicate, leaf-like and overlapping; they are arranged on the narrow epipod in a long row of more than a dozen, and with one separate and reflexed.

The large distal lobe of the third maxilliped has two conspicuous plumose setae; the ischium is long and does not differ much in length from the merus, carpus, propodus or dactylus.

This genus is close to *Sympodomma* but differs in having an exopod on the fourth peracopod of the male, and apparently in having the merus of the third maxilliped less expanded externally. It somewhat resembles *Heterocuma* but in that genus the crest of the carapace is not incised in the female, the third maxilliped has the carpus widened as in *Cyclaspis*, the terminal joint of the second

antenna of the female is tiny, the telsonic somite is very different, and the joints of the flagellum of the male second antenna, as in *Cumopsis*, are extremely short. In *Glyphocuma* (and apparently also in *Sympodomma*) the joints of this flagellum are nowhere much longer than wide, indeed, the proximal segments are twice as wide as long.

Sexual dimorphism—In the four species referred here, the ovigerous female and immature male have the crest of the carapace finely or coarsely serrate, or incised with the resultant projection or projections angular. Adult males are available for all; and these have the armature of the dorsum obliterated. The antennal notch is distinct in females but is obliterated (or "widely open") in the adult male.

The tendency of the antero-lateral portion of the fourth pedigerous somite of the male to override the third somite is in this genus emphasised in the adult, the pleural plates being produced forwards on each side into a lobe, defined above by a notch. In the female the overlapping of the second somite by the anterior pleural part of the third is also rather pronounced.

KEY TO FEMALES OF SPECIES OF GLYPHOCUMA

- 1 Anterior half of crest of carapace cut into nine or more small teeth 2
Anterior half of crest of carapace with one or two incisions, but no row of teeth. 3
- 2 Carapace twice as long as deep, with dorsal teeth inconspicuous; antennal notch narrow; ocular lobe projecting well beyond pseudorostral lobes and with corneal lenses not confined to anterior portion *bakeri* (Hale)
Carapace less than twice as long as deep, with dorsal teeth large; antennal notch wide; ocular lobe not projecting beyond pseudorostral lobes and with the small corneal lenses restricted to anterior portion *dentata* sp. nov.
- 3 Carapace slender, with two dorsal incisions, the second with two or three denticles; ocular lobe narrow, more than twice as long as wide, apically rounded when seen from above *inacqualis* sp. nov.
Carapace robust, with one dorsal incision and two or three denticles; ocular lobe as wide as long, apically angular when seen from above *serventyi* sp. nov.

KEY TO MALES OF SPECIES OF GLYPHOCUMA

- 1 Body slender, the carapace more than twice as long as deep 2
Body rather robust, the carapace less than twice as wide as deep 3
- 2 Main corneal lenses large and conspicuous; dorsal edge of carapace barely sinuate. Exopod of fourth peraeopod less than half as long as basis and with flagellum two-jointed *bakeri* (Hale)
Main corneal lenses indistinct, not large; dorsal edge of carapace markedly sinuate. Exopod of fourth peraeopod almost as long as basis and with flagellum five-jointed *inacqualis* sp. nov.
- 3 Ocular lobe narrow, more than twice as long as wide, with corneal lenses confined to anterior end which is rounded, or only minutely produced. *dentata* sp. nov.
Ocular lobe as wide as long, with corneal lenses reaching to base; anterior end as seen from above angular and projecting beyond pseudorostral lobes. *serventyi* sp. nov.

GLYPHOCUMA BAKERI (Hale)

Sympodomma bakeri Hale, 1936, 396, fig. 3 and 4.

Adult Male (10 mm., Spencer Gulf, South Australia). Integument well calcified and brittle; when dried it does not contort or shrivel. Carapace one-fourth of total length of animal, slender and compressed; its depth is less than half the length; surface generally smooth except for the distinct median dorsal carina, which becomes less prominent posteriorly; the mid-line shows no trace of the small teeth present in the female, and the dorsal margin, as seen from the side,

is barely arched and almost imperceptibly sinuate. Antennal notch widely open (or rather, the notch is completely obliterated) and angle very obtuse. Ocular lobe one-and-one-half times as long as wide; in front it is produced and narrowly subtriangular, carinate anteriorly—the little ridge extending to its apex, which thus appears acute as seen from above; three large pale corneal lenses arranged in a triangle, a smaller pair near apex, and two more on each side of lobe; the median lens is of somewhat quadrate form; the lobe is blackly pigmented, as shown in the figure. Pseudorostral lobes crenate in front, not reaching apex of eye-lobe.

Pedigerous somites together as long as carapace and a little less than half as long as pleon; the somites are angular (roof-shaped) dorsally with the median carina fine but distinct; there is a rather large pit near the rounded antero-lateral

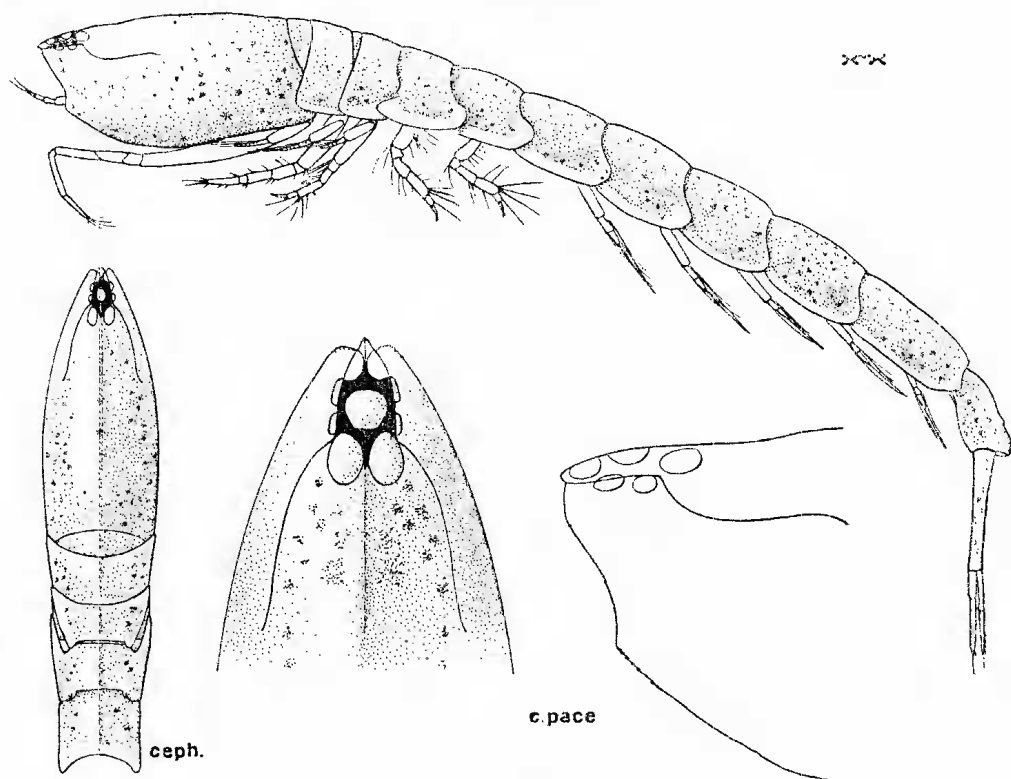


Fig. 31

Glyphocuma bakeri, adult 10 mm. male; lateral view and (ceph.) cephalothorax from above ($\times 13$); c. pace, anterior half of carapace from above and from the side ($\times 33$).

angle of the third, which overlaps the second on the sides; overriding anterior pleural part of fourth subtriangular and narrowly rounded.

The pleon is almost smooth except for a dorsal carina, which is moderately distinct on the first to fourth somites but becomes abruptly stronger on the fifth and telsonic somites.

First antenna with third joint of peduncle a little longer than second, which is half as long as the first joint; flagellum two-jointed (incompletely three-jointed); accessory flagellum two-jointed as in female.

Mandibles with about 16 spines in the long row.

Basis of third maxilliped three times as long as palp, with the dentate distal lobe reaching to beyond middle of length of carpus and furnished with two long

and stout plumose setae (as well as smaller plumose setae); ischium, merus, carpus and propodus differing little in length.

First peraeopod with carpus barely reaching beyond antennal angle; the slender basis equal in length to the remaining joints together and with short plumose setae on both margins; ischium with a distal tooth and plumose seta on inner side; carpus equal in length to propodus and half as long again as dactylus.

Basis of second peraeopod barely as long as the rest of limb, margined with plumose setae, and with a short external distal spine; merus and carpus subequal in length, each shorter than dactylus, which is three times as long as propodus; the merus has two distal outer spines and one at middle of inner margin; the carpus has two spines on inner margin, one being distal, and four of different

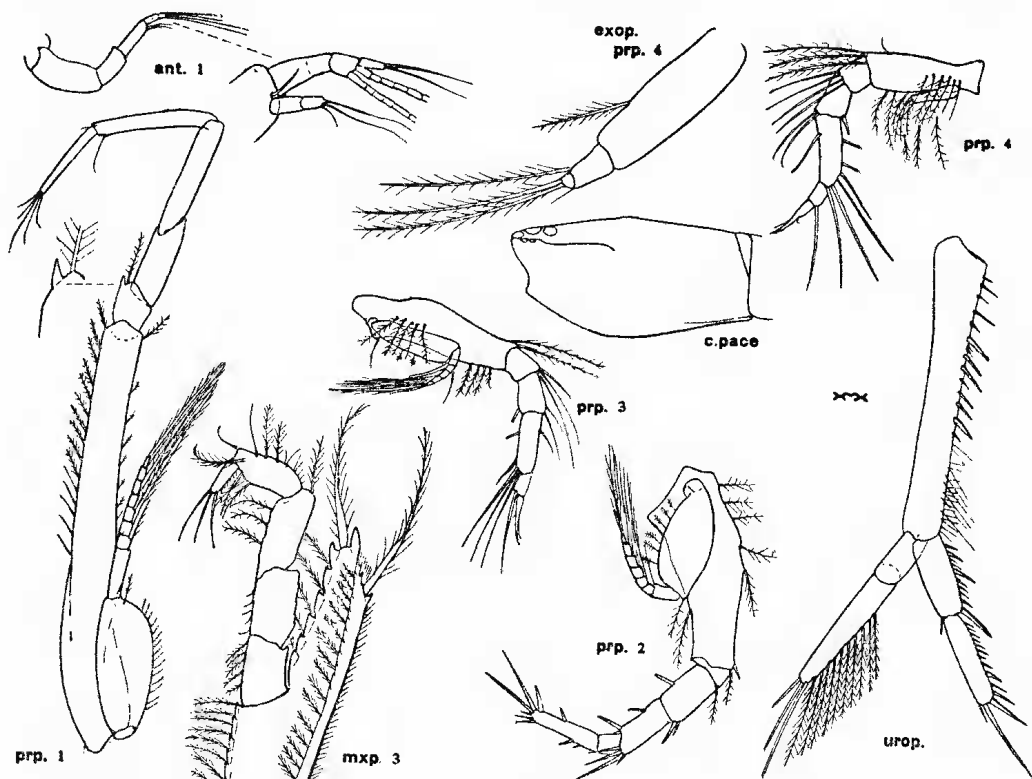


Fig. 32

Glyphocuma bakeri, adult 10 mm. male; ant. 1, first antenna (x 53; flagella, x 125); mxp. 3, palp and distal part of basis of third maxilliped (x 53); prp. and urop.; peraeopods and uropod (x 30); exop. prp. 4, exopod of fourth leg (x 125). c. pace, Carapace of 12 mm. male (x 9.).

lengths at the external apical portion; dactylus with one or two spines on each margin and a cluster of six distally, the longest about as long as the joint.

Outer distal slope of carpus of third to fifth legs with three long setae and one shorter one, the longest reaching well beyond apex of dactylus; inner and outer margins of carpus with one or two setae. The exopod of the fourth peraeopod is barely half as long as the basis of its limb and has only two joints in the flagellum; the setae are restricted to three long plumose bristles, on the flagellum and one on inner margin of peduncle.

Peduncle of uropod slender, one-fourth as long again as telsonic somite, and more than half as long again as rami; exopod a little longer than endopod, with the longest of its three slender terminal spines more than half as long as the

ramus; second segment of endopod a little longer than first and equal in length to its longest distal spine.

Colour pale yellow with brown chromatophores (see figure).

Adult Male (12 mm., St. Vincent Gulf, South Australia). The dorsal margin of the carapace, as seen from the side, is slightly angular at about the middle of the length, otherwise as with the smaller males.

Females (10 mm., from Spencer Gulf, South Australia, and with fully developed marsupium) agree in all essentials with the subadult female previously recorded, and are likewise boldly spotted with dark pigment. The dorsal carina is almost crest-like at the anterior part of the carapace, where the number of teeth into which it is cut are constant in number within a small range, approximately a dozen being present in all.

Ovigerous Female (10 mm., Portland, Victoria). Integument well calcified. Colour grey with black chromatophores on thorax and mottlings on pleon.

Loc.—South Australia: St. Vincent Gulf (*type loc.*, W. H. Baker, 1910), Brighton (Misses P. Mawson and L. M. Angel, and K. Sheard, submarine light, Oct. 1941); Spencer Gulf, Port Lincoln, 2 fath. (K. Sheard, submarine light, Oct. 1941 and Feb. 1944); Kangaroo Island, Antechamber Bay, 4 fath. (K. Sheard, submarine light, April 1941). Victoria: Portland, 8 feet, sandy bottom (H. M. Hale, submarine light, Aug. 1944).

This species was originally described from a single female, but the submarine light method of collecting proves that it is not uncommon in South Australia. A haul taken at Port Lincoln on 17 February 1944 is of particular interest; about one-tenth of the catch (which of course consisted of many different organisms) was preserved. Included in this sample *G. bakeri* is represented by over six hundred males and a score of females, all approximately 10 mm. in length. The males are all highly calcified, and are much paler in colour than the females. The latter are, in striking contrast, greyish with conspicuous colour spotting (Hale 1936, fig. 3); they have all recently moulted, the integument being soft and quickly collapsing on drying. The large marsupium is empty, and the fully developed yellow ovaries (eggs, 0.3 mm.) are visible through the thin exoskeleton (compare *Cyclaspis usitata* Hale 1944, 124).

At Brighton the larger males, 12 mm. in length, were abundant in October 1941, but no females were then taken.

The plumose hairs on the basis of the third to fifth peraeopods tend to collect flocculent debris in preserved material and so to conceal the exopods; these setae are arranged in two series which may "sandwich" the exopod, particularly that of the fourth peraeopod, which is smaller than in the male of the other three species and has only a rudimentary two-jointed flagellum in both 10 mm. and 12 mm. examples. It is very like the exopod occurring on the second and third peraeopods in *Heterocuma intermedia* (Fage 1924, 364, fig. 1), differing only in having a second tiny joint in the flagellum.

***Glyphocuma dentata* sp. nov.**

Ovigerous Female. Integument thin and delicate, scarcely at all calcified.

Carapace somewhat less than one-fourth of total length of animal; depth distinctly more than half the length; subtriangular as seen from above, widest near posterior end, where it is as broad as deep; upper contour slightly arched; dorsum with a median longitudinal carina, on anterior half cut into about ten teeth the last minute and on posterior half rather rugose; anterior part of inferior margin, immediately behind antennal tooth serrate; on each side of the front half

of the mid-line there is a shallow depression delimited by a low lateral tumidity; antennal notch moderately deep and open and antennal tooth subacute. Ocular lobe about three times as long as wide, rounded anteriorly and with nine small lenses in frontal part, eight grouped around a central one; the first two of the dorsal teeth are situated on the lobe. Pseudorostral lobes very oblique in front, extending almost to apex of ocular lobe.

Pedigerous somites together equal in length to carapace, each with a median dorsal carina; first overlapped by second but visible for whole depth; second somite widest the others successively decreasing in breadth, so that, viewed from above, the cephalothorax is sub-oval in shape.

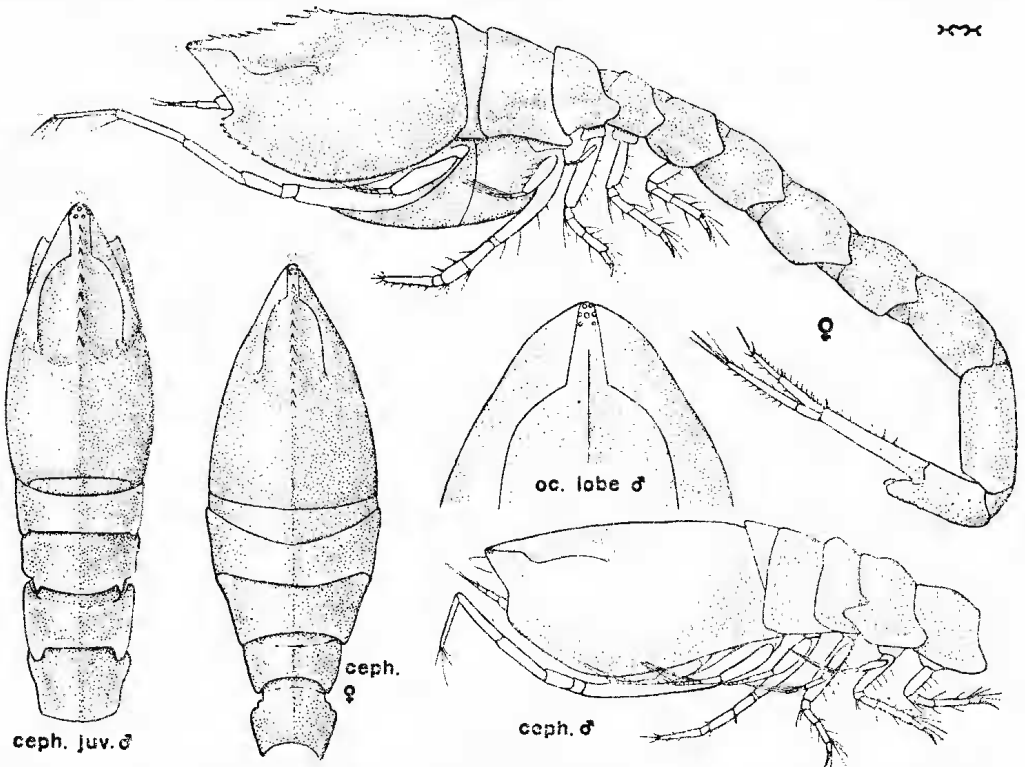


Fig. 33

Glyphocuma dentata; lateral views and (ceph.) upper view of cephalothorax of type ovigerous female and allotype adult male (x 19); oc. lobe, ocular lobe of adult male (x 33); ceph. juv., cephalothorax of subadult male from above (x 19).

Pleon somites each with a fine dorsal carina; postero-lateral margins of first to fourth angularly produced backwards, those of fifth less markedly angular; all but fifth approximately equal in length; telsonic somite produced between bases of uropods.

First antenna with second and third joints of peduncle subequal in length, together almost as long as first joint and each shorter than the two-jointed flagellum; accessory lash two-jointed.

Mandible with usual long spine row of 18 to 20.

Basis of third maxilliped twice as long as rest of limb, and with well-developed external apical lobe, reaching distal end of the slightly dilated merus.

First pereopod long and slender, the carpus extending to beyond the antennal tooth; basis not much more than two-thirds as long as rest of leg, distally subtruncate and with some plumose setae and (at middle third) three spines on inner

margin; propodus nearly one-fourth as long again as carpus, which is as long as the dactylus.

Second peraeopod with basis shorter than remaining joints together; ischium very short; merus as long as carpus, with two distal spines; carpus with distal spines and one on inner margin; dactylus elongate, four times as long as propodus and as long as carpus and propodus together; with short lateral spines and four distal, the longest of which is only one-fourth the length of the dactylus.

Third to fifth peraeopods with three setae at distal end of carpus, the longest reaching beyond tip of dactylus.

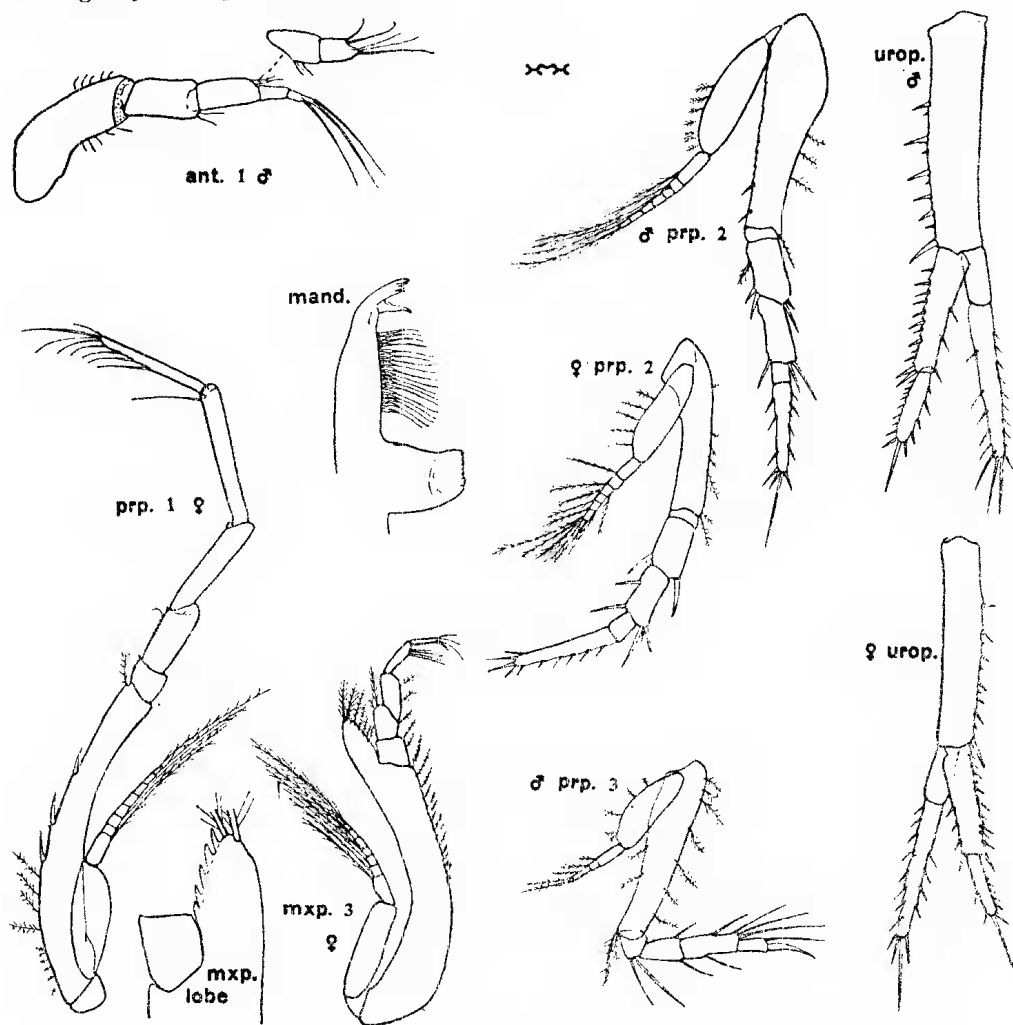


Fig. 34

Glyphocuma dentata, paratype ovigerous female and subadult male; ant. 1, and mand., first antenna and mandible ($\times 85$); mxp. 3, prp. and urop., third maxilliped, peraeopods and uropods ($\times 32$); mxp. lobe, external distal lobe and ischium of third maxilliped, plumose setae omitted ($\times 170$).

Peduncle of uropod a little longer than telsonic somite, and than exopod. with half-a-dozen spines, alternating with shorter spines, on inner margin and a more prominent spine at inner apical angle; first joint of endopod half as long again as second, with ten unequal spines on inner edge, several on outer, and a more prominent spine at inner distal angle; second joint of endopod with a row

of short spines successively increasing in length on inner margin and a few on outer, and with a terminal spine as long as the joint; exopod a little longer than endopod, its second segment with spines on both margins and with the longest terminal spine as in endopod.

Colour: pale translucent yellow spattered with brown all over body, leaving margins of carapace and somites pale; darker on front of carapace and with a large brown marking above each pseudorostral suture and a smaller one below it. Eye darkly pigmented. Legs translucent. Ova dark yellow.

Length, 7 mm.

Adult Male. Carapace more slender than in female and lacking all trace of dorsal teeth, the upper edge being very faintly sinuate; there is a small shallow subcircular depression above the end of each pseudorostral suture, and below this a small tumidity immediately behind end of suture; median carina distinct, sharply defined anteriorly. Antennal notch very obtuse (widely open) and angle rounded; margin of carapace posterior to angle with obsolete serrations. Ocular lobe slightly widened at base, twice as long as breadth and with lenses small and situated near the apex.

Pleural portions of first pedigerous somite not at all exposed.

First peraeopod not quite so long as in female.

Second peraeopod with basis almost as long as rest of limb and terminal spine of dactylus nearly as long as its joint.

Last pair of pleopods abruptly smaller than the first four.

Endopod of uropod almost as long as exopod.

Colour as in female.

Length, 7.1 mm.

Submature Male. Males about as long as the adult but with the pleopods not fully developed exhibit the above sexual differences excepting that the dorsal teeth of the carapace are still present (fig. 33, ceph. juv.).

Loc.—New South Wales: off Cape Three Points, 25-32 fath., sticky mud and shell ("Thetis" Station 13, Feb. 1898); off Jibbon, 46-55 fath., sand to mud ("Thetis" Station 38, Mar. 1898); 5 miles east of Port Hacking, 100 metres, on mud (type female, "Cronulla" Trawl Station, July 1943); 4 miles off Eden, 70 metres (K. Sheard, Oct. 1943); 4 miles east of Port Hacking, 80 metres, on mud (K. Sheard, trawled, May 1944); Ulladulla, 75 metres (allotype male, K. Sheard, trawled, June 1944). Types in South Australian Museum, Reg. No. C.2464 and C.2542.

The largest examples, taken off Eden, are just over 8 mm. in length.

This, like *inaequalis*, is a common species in the localities cited. It is noted for both that the "Cronulla" examples retained represent only portions of a haul.

The dorsal teeth of the carapace of female and subadult male vary in number between nine and twelve. As in the other species of the genus, the full development of the swimming apparatus of the male coincides with the loss of the armature of the carapace.

***Glyphocuma inaequalis* sp. nov.**

Origerous Female. Integument smooth and rather polished, with very fine reticulate pattern.

Carapace less than one-fourth of total length of animal; slender, twice as long as depth which is equal to the greatest width; seen from above the sides are slightly curved and diverge evenly to the rear; dorsum with a prominent carina

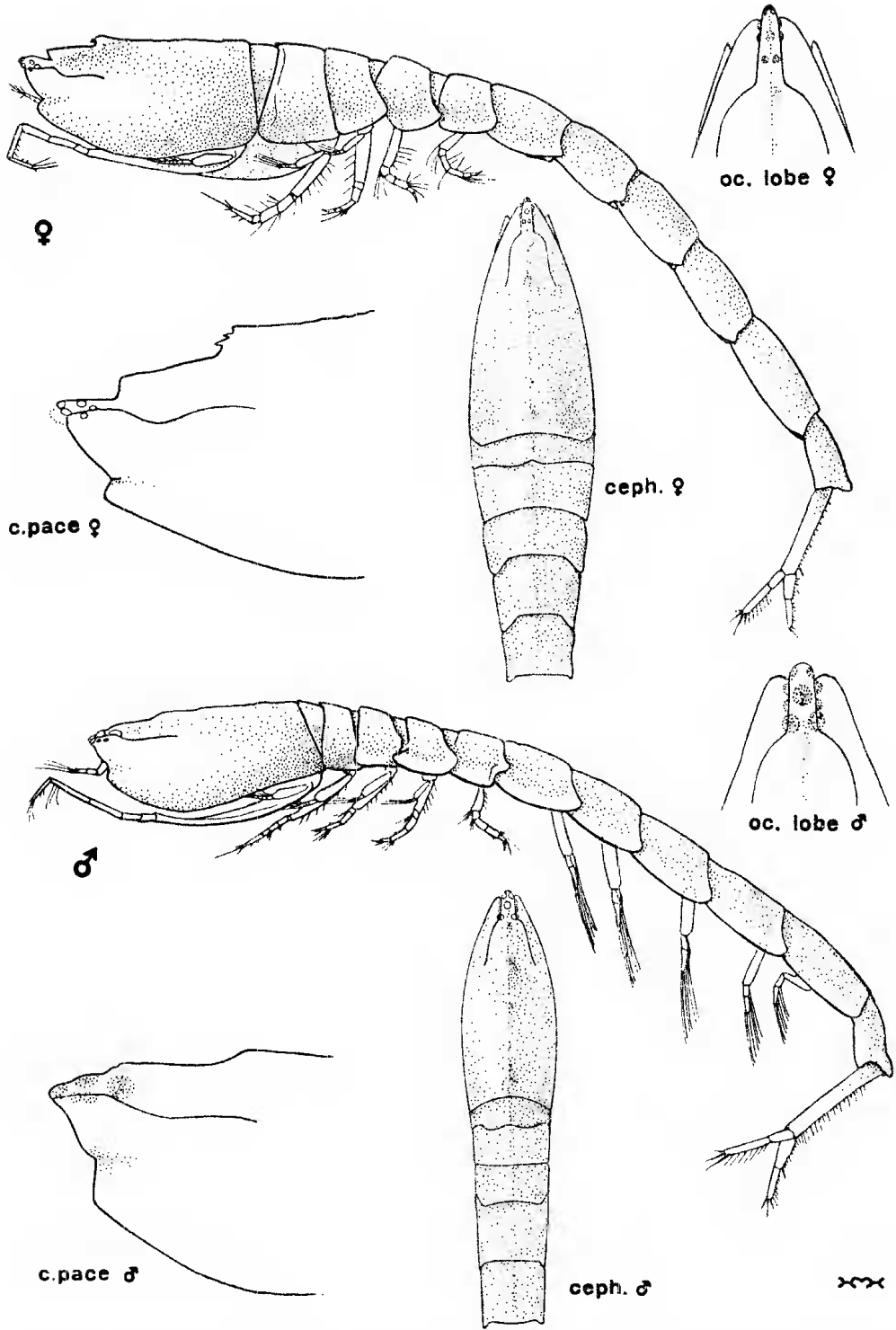


Fig. 35

Glyphocuma inaequalis, type female and allotype male; lateral views and (ceph.) cephalothorax from above (x 10); c. pace, anterior half of carapace from the side; and oc. lobe, ocular lobe, etc. (x 25).

from apex of ocular lobe to hinder margin; seen from the side the dorsal margin is elevated to form a short and abrupt declivity immediately posterior to the ocular lobe and again at the first third of its length (see fig. 35, c. pace); the edge of the second incision is cut into two denticles; for the posterior two-thirds the dorsal margin is almost straight, slightly uneven. Antennal notch widely open and angular; antennal tooth rounded. Ocular lobe narrow, about three times as long as greatest width (basal) narrowly rounded in front and with nine pigmented but not sharply defined lenses. Pseudorostral lobes rounded anteriorly and not reaching apex of ocular lobe.

Pedigerous somites together longer than carapace, and half as long as pleon; each with low dorsal carina; second somite longer than any of the others, its rounded antero-lateral portion overlapping the first somite and the extreme postero-lateral angle of carapace; postero-lateral portions of third to fifth somites a little produced backwards, and rounded.

Pleon somites each with a median dorsal carina, all but fifth of about equal length; telsonic somite scarcely produced between bases of uropods.

First antenna with third joint of peduncle shorter than second, which is half as long as first; flagellum two-jointed, not as long as third peduncular segment; accessory flagellum two-jointed.

Mandible with the usual long row of 18 or 19 spines.

Third maxilliped with basis nearly three times as long as rest of limb and with the external apical angle strongly produced, the lobe reaching to level of the slightly expanded distal portion of merus.

First peraeopod long, the carpus extending beyond level of antennal angle; with the slender basis a little longer than remaining joints together and having short plumose setae on both margins, and one at external distal angle; carpus and propodus subequal in length, each shorter than dactylus, which is about as long as merus.

Second peraeopods with basis shorter than rest of limb, with plumose setae on both margins, and a short apical spine; ischium short with one spine; merus as long as carpus with a subapical spine on each margin; carpus with two spines (one apical) on inner margin and two, unequal, at outer distal angle; dactylus more than twice as long as propodus, with three apical spines (the longest as long as propodus and dactylus together), two on outer margin and one on inner.

Basis of third legs as long as rest of limb, of fourth shorter, of fifth much shorter; outer apical portion of carpus with three setae and inner margin with two or three; the longest fossorial setae reach beyond apex of dactylus.

Peduncle of uropod slightly longer than telsonic somite, the inner margin with short spines of different lengths; endopod as long as exopod, the first joint a little shorter than second and with a row of spines on inner edge, and one specialised, at outer distal angle; of the inner spines, one at middle of length is prominent and one at inner distal angle is particularly strong; second joint of endopod with a spine two-thirds length of segment and two shorter spines at rounded apex and a row of spines on inner margin; exopod two-thirds as long as peduncle with half-a-dozen short plumose setae on inner margin, a few short spines on outer margin and five apical spines the largest half as long as exopod.

Colour: spattered with dark brown, leaving carapace and somites margined with the pale creamy-white ground colour; also there are pale circular areas scattered all over the body and particularly well defined on the carapace.

Length, 13.5 mm. (ova, 0.34 mm.).

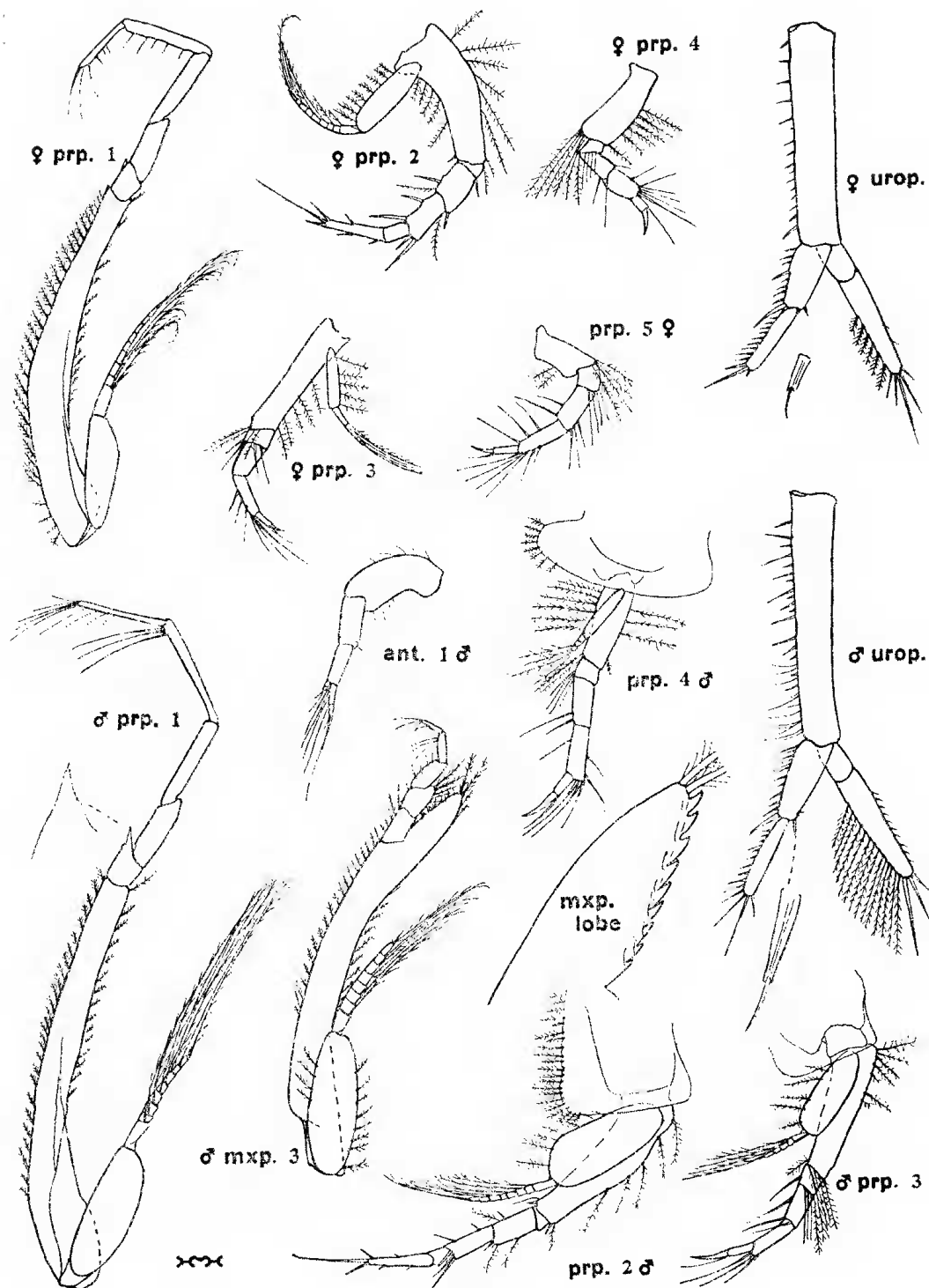


Fig. 36

Glyphocuma inaequalis, type ovigerous female and paratype male; ant. 1, first antenna (x 40); mxp. 3, prp. and urop., third maxilliped, peracopods and uropods (x 25); mxp. lobe, external distal lobe of third maxilliped, with setae omitted (x 210).

Adult Male. Form not differing much from that of female but carapace more compressed (less than half as wide as long); incisions of dorsal edge more oblique, thus appearing less pronounced, and without denticles in second. Ocular lobe a little wider and the lenses larger, with distinct granules. Antennal notch more widely open.

Second pedigerous somite not longer than any of the others.

First peraeopod longer, with carpus shorter than propodus and about as long as dactylus; propodus with a few long subapical setae, and dactylus with more abundant setae; ischium with a tooth at inner distal angle.

Second peraeopod with basis as long as rest of limb, but otherwise much as in female.

Uropod with peduncle proportionately longer and with endopod slightly longer than exopod; outer distal spine of first joint of endopod larger and exopod with a greater number of plumose setae.

Colour decidedly paler than that of female with small separated brown spots; the pale circular areas without dark pigment are nevertheless well defined.

Submature Male. Immature males, about as long as the adult but with pleopods not quite fully developed, have dorsum of carapace as in the female; it is likewise remarkably uniform, the only variation being in the number of denticles (two or three) in the second dorsal incision.

Length, 12.5 mm.

Loc.—New South Wales: off Jibbon, 3 to $2\frac{1}{4}$ fath., sand to mud ("Thetis" Station 38, Mar. 1898); Broughton Island, Shallow Station (K. Sheard, 11 p.m. to 12 midnight, Dec. 1938); off Jibbon, 35 fath., in coarse sand (K. Sheard, Feb. 1940); off Coffs Harbour, 50 metres (K. Sheard, trawled, June 1941); 5 miles east of Port Hacking, 100 metres on mud ("Cronulla" Trawl Station, July 1943); off Wata Mooli, 70 metres ("Cronulla" Trawl Station 4, 9 a.m., July 1943); Jibbon Station, 70 metres (*type loc.*, "Cronulla" Trawl Station 3, July 1943); 4 miles east of Port Hacking, 80 metres, on mud (K. Sheard, trawled, May 1944); Ulladulla, 75 metres (K. Sheard, trawled, June 1944). Tasmania: off Babel Island, 0-50 metres ("Warreen" Station 29, 1939). Types in South Australian Museum, Reg. No. C.2453 and C.2454.

This form, evidently not uncommon, is readily recognised by the slender form and the distinctive shape of the dorsal margin of the carapace in both sexes.

***Glyphocuma serventyi* sp. nov.**

Ovigerous Female. Integument thin but firm, finely reticulate.

Carapace one-fourth of total length of animal; its depth is equal to three-fourths its length, and is scarcely more than the greatest width; seen from above it is widest posteriorly and tapers to the front; dorsal margin in lateral view scarcely arched but abruptly incised at first third of length, the incision with two small denticles, one of which is minute; there is a distinct median dorsal carina, single anteriorly but bifurcating and diverging posterior to the incision; the thin anterior portion of the carina bends abruptly downwards at front of ocular lobe, from above presenting the appearance of a triangular point projecting beyond the pseudorostral lobes; at the posterior end of each pseudorostral suture there is a low tubercle. Antennal notch rather deep and narrow; antennal angle acute; there is a shallow groove behind the notch and the inferior margin of the carapace behind the tooth is serrate for a short distance. Pseudorostral lobes not quite reaching to end of eye lobe, narrowly subtruncate in front. Ocular lobe

slightly longer than wide, with pigmented lenses, three arranged in a triangle larger and more conspicuous than the others.

Pedigerous somites with an almost indiscernible median dorsal carina; together they are almost as long as carapace and seen from above the second is much the widest; the postero-lateral portions of the third to fifth are not greatly backwardly produced.

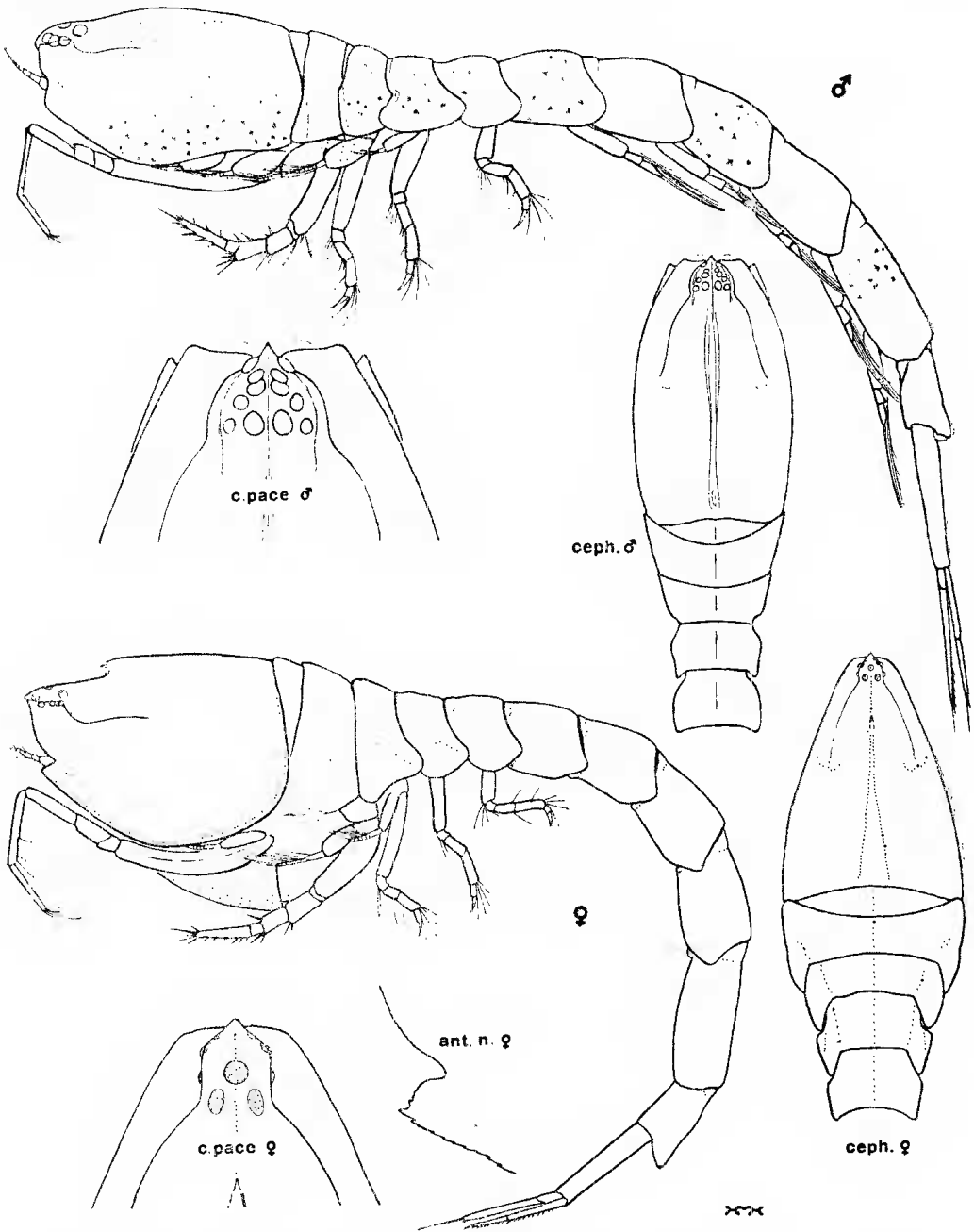


Fig. 37

Glyphocuma serrentyi, type female and allotype male; lateral views and (ceph.) cephalothorax from above ($\times 16\frac{1}{2}$); c. pace, anterior portion of carapace ($\times 33$); ant. n, antennal notch and angle, slightly flattened ($\times 33$).

Pleon with an obsolete dorsal carina, the somites excepting fifth subequal.

First antenna with massive first peduncular joint as long as rest of appendage, and with second shorter than third; both flagella two-jointed, the accessory lash as usual very short.

Mandible with long row of 18 or 19 spines.

Basis of third maxilliped (including lobe in the measurement) twice as long as palp, serrate and with plumose hairs on distal half of inner margin; the external lobe reaches to the level of the distal margin of carpus, is strongly dentate on inner edge and is capped with a pair of plumose setae stouter than the other fringing setae.

First peraeopod with carpus reaching just beyond level of antennal tooth; basis not produced apically and with a plumose seta at external distal angle; inner margin with the usual plumose setae and three spines, the last subapical; the remaining joints together are half as long again as the basis; propodus one-third as long again as dactylus which is subequal in length to carpus.

Second peraeopod with basis much shorter than rest of leg; ischium distinct; merus and carpus of equal length, together about as long as dactylus; merus with one or two distal spines on each side; carpus with two spines on inner margin and a cluster of four at external distal angle; propodus very short; dactylus with marginal spines and a distal cluster of five unequal spines the longest little more than half length of the joint.

Third to fifth peraeopods with three carpal setae, decreasing in length, the longest, like propodal setae, not reaching beyond tip of dactylus; basis of third pair longer than rest of limb, of fourth and fifth shorter.

Peduncle of uropod little longer than either telsonic somite or exopod, and with a row of about 14 stout spines, alternately short and longer, on inner edge; exopod slightly longer than endopod, twice the length of the longest of its four terminal spines and with few setae on inner margin; first joint of endopod three-fourths as long again as second with a row of unequal inner spines and a spine at each distal angle, that on the inner side the stouter; second joint with half-a-dozen short spines, successively increasing in length and with two short and one long apical spine, the latter fully as long as the joint.

Colour: white, mottled with dark grey.

Length, 8.3 mm.

Adult Male. There is no trace of an incision in the scarcely arched, slightly sinuate dorsal profile of the carapace; the latter is as wide as deep, narrower than in female and with the sides evenly curved; not at all subtriangular as seen from above; the median carina is double for the greater part of its length (a furrow with raised edges, and emphasised as a shallow pit near posterior margin). Pseudorostral lobes sinuate and rather widely truncate in front and with a few low tumidities posteriorly. Ocular lobe depressed along sides, wider than long and with lenses larger and more conspicuous than in female, but projecting similarly in front of pseudorostral lobes as a triangular point. Antennal notch shallow and widely open; antennal angle obtuse.

Third maxilliped as in female.

First peraeopod with basis not much shorter than remaining joints together; the whole limb scarcely longer relatively than in female, although the carpus and propodus are a little longer in proportion to the other joints; ischium with a subapical inner tooth.

Second peraeopods with basis stout and almost as long as rest of limb; spines more robust but otherwise as in female.

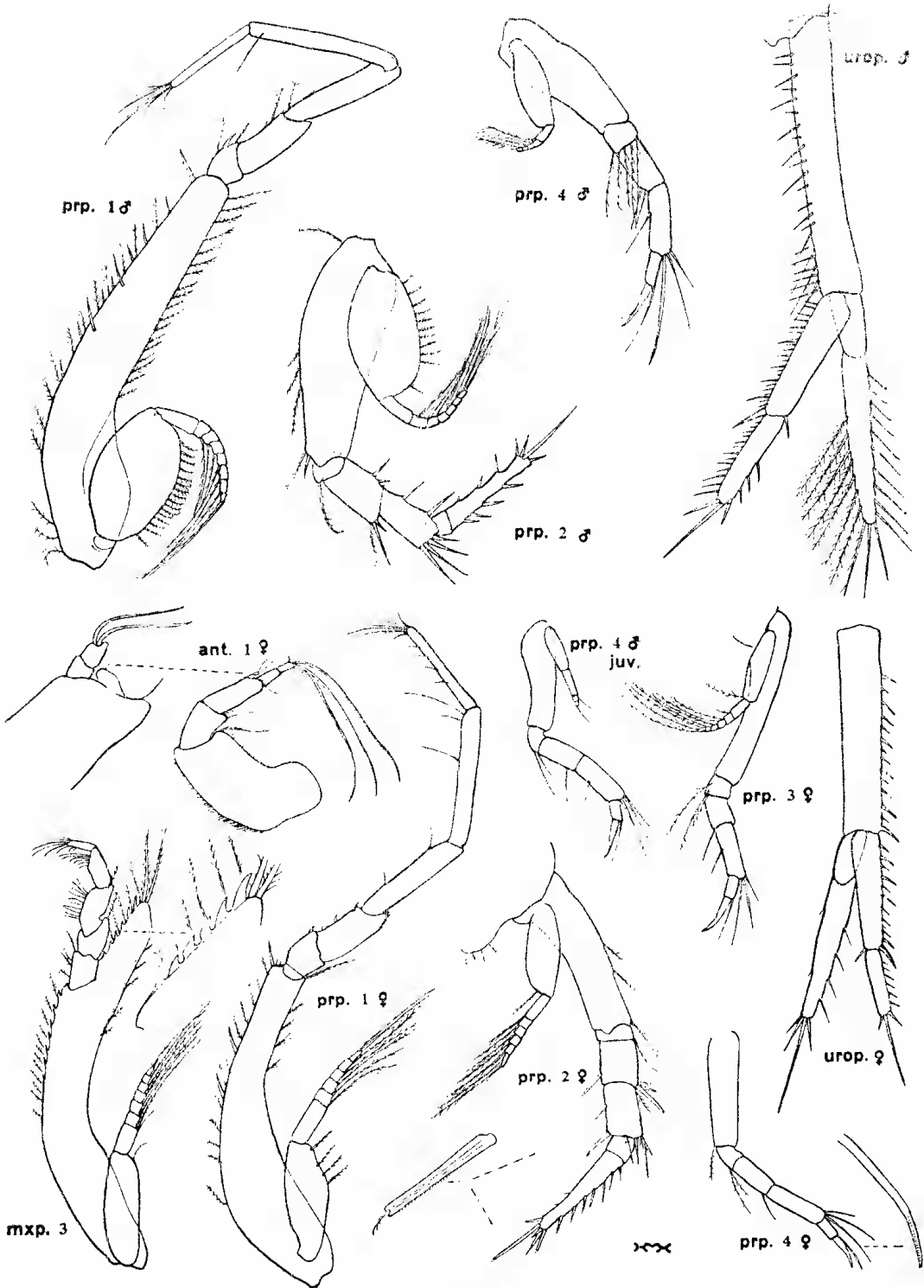


Fig. 38

Glyphocuma serventyi, paratype female and allotype male; ant. 1, first antenna (x84; accessory flagellum, x400); mxp. 3, prp. and urop., third maxilliped, pereopods and uropods (x34). prp. 4 juv., fourth pereopod of young male.

The flagellum of the exopod of the fourth peraeopods is short and five-jointed, with setae not very long.

Peduncle of uropod distinctly longer than either telsonic somite or uropod, with longer and slightly more numerous spines; endopod with twice as many marginal spines as in female and with first joint less than half as long again as second, which has the longest terminal spine shorter than the joint.

Length, 8.5 mm.

Subadult Male. A large but immature male has the dorsal margin of the carapace incised and with two small teeth as in the female; in addition, there is a small denticle midway between the incision and apex of ocular lobe. The exopod of the fourth peraeopod has a three-jointed flagellum and the pleopods are not fully developed and lack setae. The first peraeopod is a little shorter than in the adult, the basis of the second peraeopod (as in the female) is much shorter than rest of limb, and there are other slight differences due to immaturity.

Length, 8.5 mm.

Loc.—Tasmania: Long Island, off Cape Barren Island (allotype male, D. L. Serventy, submarine light, Nov. 1939) and off Babel Island, 39° 55' S., 148° 31' E. ("Warreen" Station 29, 1939). New South Wales: off Jibbon, 35 fathoms on coarse sand (type female, K. Sheard, Feb. 1940). Types in South Australian Museum, Reg. No. C.2476 and C.2479.

This species is named after Dr. D. L. Serventy, Biologist on the "Warreen." It is distinguished by the deep carapace, projecting point at apex of ocular lobe and other obvious features.

GENUS SYMPODOMMA Stebbing

Sympodomma Stebbing, 1912, 138; and 1913, 15.

As noted above, in the known species of *Glyphocuma*, females and immature males always have the crest of the carapace serrate or incised, but this armature is obliterated or smoothed out in the fully developed male. The few recorded specimens of *Sympodomma* suggest that this obtains here also.

Five species have been placed in Stebbing's genus. One of these, *anomala* (Sars), must, in view of *Glyphocuma*, be regarded as doubtfully referred, as it is known only from the female; this has dorsal teeth on the carapace. The immature males and females described for *diomedea* (Calman) and *africana* Stebbing have a dentate crest. *S. weberi* (Calman) is known from an adult male, which has the dorsum of the carapace unarmed but slightly, though distinctly, sinuate. The fifth species, *australiensis* Foxon is the only other in which the mature male is recorded, and here also the dorsum is without serrations according to Foxon's fig. 5, but the female is stated to have "a marked dorsal ridge, which terminates anteriorly in a sharp tooth over the typical elongated ocular lobe, and the ridge is armed by a few hairs and three or four small denticles." (Foxon, 1932, 388.)

Stebbing depicts 10 or 11 leaflets in the branchial apparatus of his *africana*. In the figures of this species, and of Calman's *weberi* and *diomedea*, the merus of the third maxilliped is shown as rather more expanded than it is in the species herein placed in *Glyphocuma*.

E R R A T A

P. 270, in key to males, second line: for "wide" read "long."

P. 284, after last line, add: "represent a new species, but description awaits more material."

SUMMARY

It is suggested that two subfamilies, the Bodetriinae and Vaunthompsoniinae, be recognised. The genus *Cyclaspis* of the first-named was reviewed previously (Hale 1944), and herein *Bodotria maculosa* and *Iphinoe pellucida* are described as new.

In the Vaunthompsoniinae two new genera, *Zenocuma* and *Pomacuma*, allied to *Gephyrocuma* Hale, are proposed; the first peraeopods in these three genera can be folded to form the major part of an operculum which seals the cavity of the carapace from the exterior. Also, *Glyphocuma*, gen. nov., allied to *Symphodomma* Stebbing, receives four species, the sexual dimorphism of which is recorded, while the genus *Leptocuma* Sars is discussed and a key is given to all the genera included. Species described as new are *Zenocuma rugosa*, *Pomacuma cognata*, *Gephyrocuma repanda*, *Leptocuma vicaria*, *L. obstipa*, *L. serrifera*, *L. intermedia*, *Vaunthompsonia nana*, *Glyphocuma inaequalis*, *G. dentata*, and *G. serrentyi*.

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